Engineering
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MACHINE DESIGN

AS IT AFFECTS

ENGINEERING—PRODUCTION—SALES

POWER OUT OF CONTROL ALWAYS MEANS *Waste*

And yet

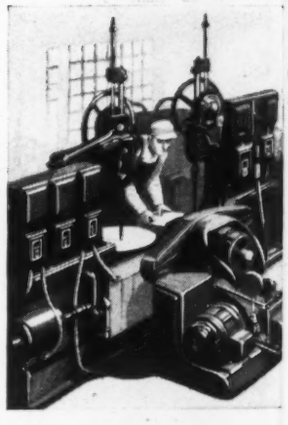
NO NEWS REEL EVER PICTURES THE RAVAGES OF INDUSTRY'S *Power-out-of-Control*

WATER power furnishes light and heat, does the hard work for many towns. Yet when this same power goes out-of-control it destroys where it has served.

Power out of control always means *waste*. Whether the horsepower in Industry's millions of electric motors wastes where it should save or destroys where it should create depends on *control*.

Executives recognizing this great importance of Motor Control specify Cutler-Hammer Control for every motor drive. They agree that nothing justifies substitution for Cutler-Hammer performance.

So widespread is this recognition for Cutler-Hammer superiority that many outstanding builders of motor-driven machines standardize on Cutler-Hammer Motor Control and actively feature it in their selling. The majority of electric motor manufacturers recommend it. Leading independent electrical wholesalers stock it for your convenience. Be sure your plant capitalizes the importance of Motor Control. Specify Cutler-Hammer for every motor or motorized machine. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus*, 1310 St. Paul Ave., Milwaukee, Wis.



This is the third of a new series of Cutler-Hammer advertisements in national magazines. Has appeared in Aug. 6 TIME; will appear in September FORTUNE. C-H Motor Control, most widely advertised, is a definite sales asset for any motorized machine. Standardize on Cutler-Hammer to speed your selling and assure the utmost in performance. C-H Machine Designers' Motor Control Manual supplied at no cost when requested on company letterhead.

CUTLER HAMMER

THE CONTROL EQUIPMENT C-H GOOD ELECTRIC MOTORS DESERVE

MACHINE DESIGN

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VOLUME VI SEPTEMBER, 1934 NUMBER 9

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NOW . . . more than ever . . . New Departure Ball Bearings are the ideal support for machine tool spindles. » » » Now it is possible to bore housings *straight through* at one set-up, greatly simplifying machining and assuring perfect alignment of the bearings. » » » The bearings are separable for quick and easy assembly. » » » Inner rings are extra wide to assure firm, non-deflecting seating and are key-slotted so that they may be locked to prevent creeping about the shaft. Preload is applied through one of the bearing inner rings. » » » New Departure *flanged* precision ball bearings make for economical assembly in any type of machine where a rigid precision bearing, with provision for both radial and thrust loads is required. » » » Literature on request. The New Departure Manufacturing Company, Bristol, Connecticut.

FLANGED PRECISION SPINDLE BEARINGS

by

NEW DEPARTURE

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Classified for Convenience when Studying Specific Design Problems

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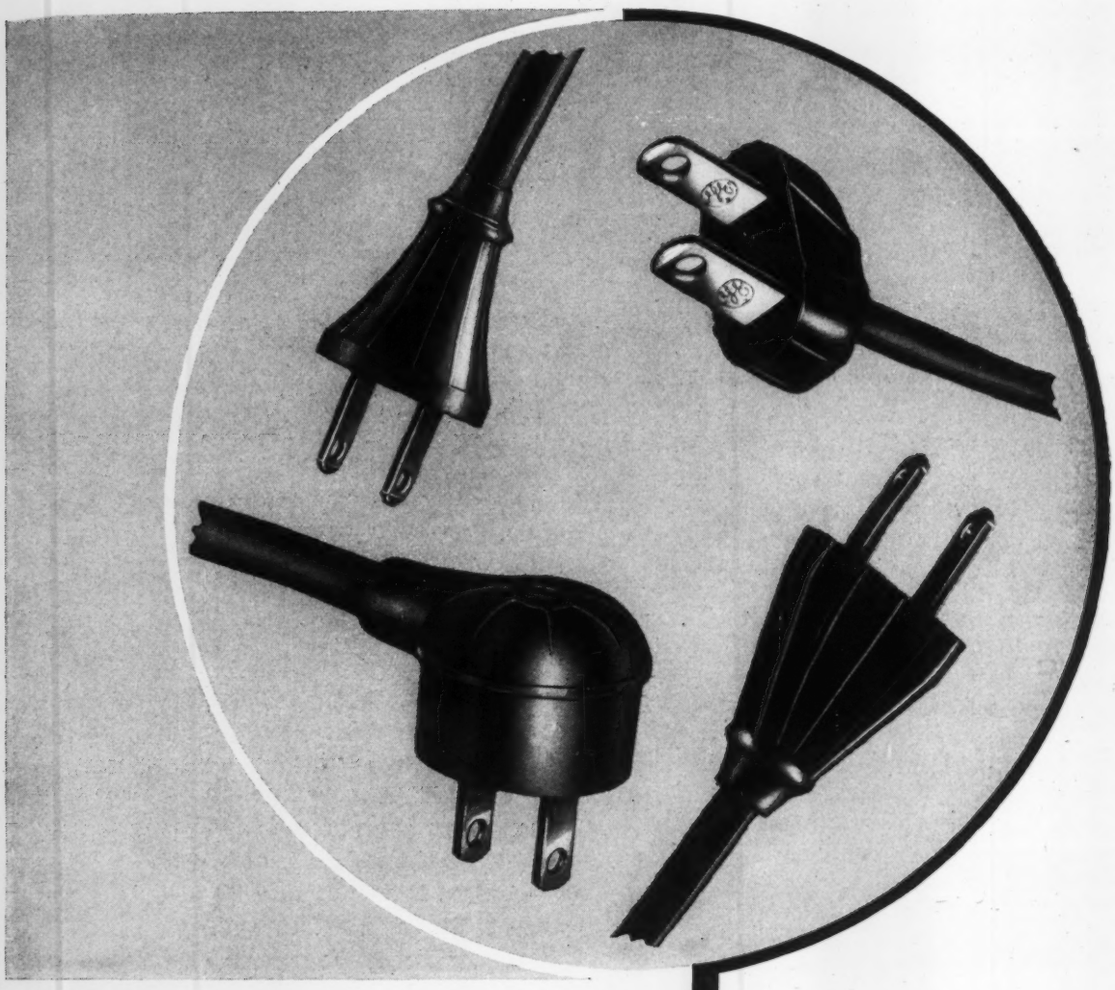


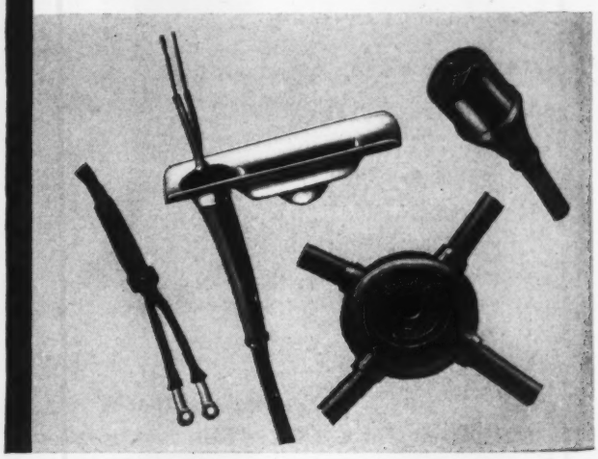
DEPENDABILITY
BEGINS AT THE PLUG

The best appliance, tool or electrical equipment cannot give service if the plug or cord fails to function.

Assure continued dependable performance. Use General Electric Cords with the Plugs MOULDED ON. Only General Electric can supply this sturdy construction that guarantees satisfaction.

For further information, write Section Q-459, Merchandise Department, General Electric Company, Bridgeport, Connecticut.

Rubber connectors, strain reliefs and delta connections are all moulded on the cord.



GENERAL ELECTRIC

ACCESSORY EQUIPMENT

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

NEW LUBRICATION SYSTEM ADDS EXTRA SELLING FEATURE TO YOUR EQUIPMENT

. . . at little or no increase in cost

●

MACHINERY NOW IN OPERATION EASILY MODERNIZED BY CHANGING OVER TO NEW ALEMITE HYDRAULIC LUBRICATION FITTINGS

● Any machine equipped with the new Alemite Hydraulic Lubrication System takes less time, labor and lubricant to operate and maintain. That means it's *easier to sell.*

The new Alemite Hydraulic Lubrication System is *more* than a mere improvement on a previous method of lubrication. *It assures positive lubrication of all bearing points!* Its standardization will add an important *new* sales feature to your equipment. Machinery now lubricated by oil holes, grease cups, or even former Alemite Systems can also be quickly and easily changed over to the new Alemite Hydraulic Lubrication System.

Write Today for Full Engineering Information

ALEMITE CORPORATION
Division of Stewart-Warner Corp'n.
1890 Diversey Parkway Chicago, Illinois

WITH OUR NEW MODEL, WE CAN GUARANTEE YOU MORE EFFICIENT AND LOWER COST OPERATION DUE TO THE NEW ALEMITE HYDRAULIC LUBRICATION!
—AND YOU SAY I CAN CHANGE THE REST OF OUR PRODUCTION LINE OVER TO THIS NEW SYSTEM?

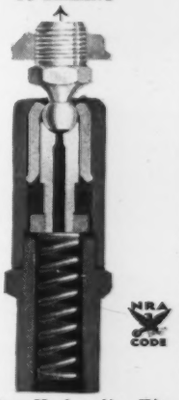
BASIC PRINCIPLE OF NEW ALEMITE HYDRAULIC LUBRICATION SYSTEM

THIS new system embodies a new principle of applying lubricant through new fittings. It cuts time, labor and lubricant required to service bearings and assures positive lubrication under any and all conditions.

A coupling of entirely new design is used in combination with a new-style fitting or nipple to effect the most perfect seal which has ever been possible. This coupling actually grips the fitting so quickly that contact between gun and any fitting is established instantly.

The coupling STAYS LOCKED on the fitting—cannot slip off—so long as pressure is being applied. As pressure increases, the grip of the coupling increases—"the greater the pressure, the tighter the seal." With this system, it is easily possible to build pressures up to 10,000 pounds per square inch by hand!

Like former Alemite systems, the new Alemite Hydraulic comprises fittings of all necessary angles and sizes, and adapters for both power and hand operated guns.



Alemite Hydraulic Fitting with cross-sectional view of coupling.

ALEMITE NEW HYDRAULIC LUBRICATION SYSTEM

take advantage of Modern Metals

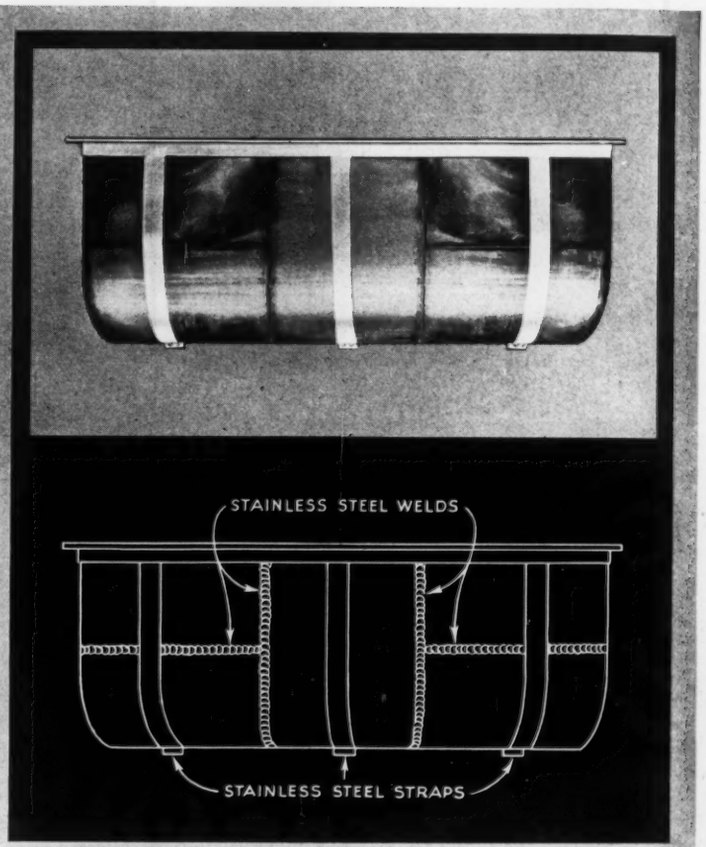
Design for OXWELDING

IN THE fabrication of stainless steel and other corrosion-resistant metals and alloys, oxwelding assures a smooth, corrosion-resistant joint.

The manufacturer of this milk storage tank called on Linde Process Service to help in developing a type of oxwelded joint which would assure a smooth interior wall and avoid warping of the light stainless steel sheet. On Linde's recommendation all seam edges were flanged 3/16 in. Each edge was thus at right angles to the main part of the sheet for the full length of each section. The flanged edges were then placed together and welding started at one end, melting down the flanges to form the weld without the use of welding rod. This procedure completely eliminated any trouble in warping and also gave a joint that was perfectly flush on the inside of the seam. Orders for the construction of additional tanks along identical specifications throughout confirmed the customer's approval of the job.

Perhaps your metal product would be better with oxwelded joints. Linde Process Service can answer this question for you.

A letter or telephone call to the nearest Linde Sales Office will bring you information on this service. There is no obligation—and you will benefit from the many years of experience in the development of the oxy-acetylene process which the Linde organization commands.



In redesigning this 700 gal. tank for milk storage, it was necessary to eliminate an unsanitary and corrosion-ridden condition. With the help of Linde Process Service the tanks were redesigned to be made from stainless steel with oxwelded joints. The inside and outside are permanently free from undesirable laps where germs might lodge or corrosion might start.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

126 Producing Plants UCC 859 Warehouse Stocks

IN CANADA, DOMINION OXYGEN CO., LTD. TORONTO

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES • UNION CARBIDE

PRODUCT OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

You are cordially invited to visit the numerous exhibits sponsored by the Corporation in both the Basic and Applied Sciences in the Hall of Science at Chicago's 1934 A Century of Progress Exposition. Here you will see how users of products and processes developed by Units of Union Carbide and Carbon Corporation benefit from a most unique coordination of scientific research with manufacturing, sales and service facilities.

Sales Offices:

Atlanta	Houston	Portland, Ore.
Baltimore	Indianapolis	St. Louis
Birmingham	Kansas City	Salt Lake City
Boston	Los Angeles	San Francisco
Buffalo	Memphis	Seattle
Butte	Milwaukee	Spokane
Chicago	Minneapolis	Tulsa
Cleveland	New Orleans	
Dallas	New York	
Denver	Philadelphia	
Detroit	Phoenix	
El Paso	Pittsburgh	

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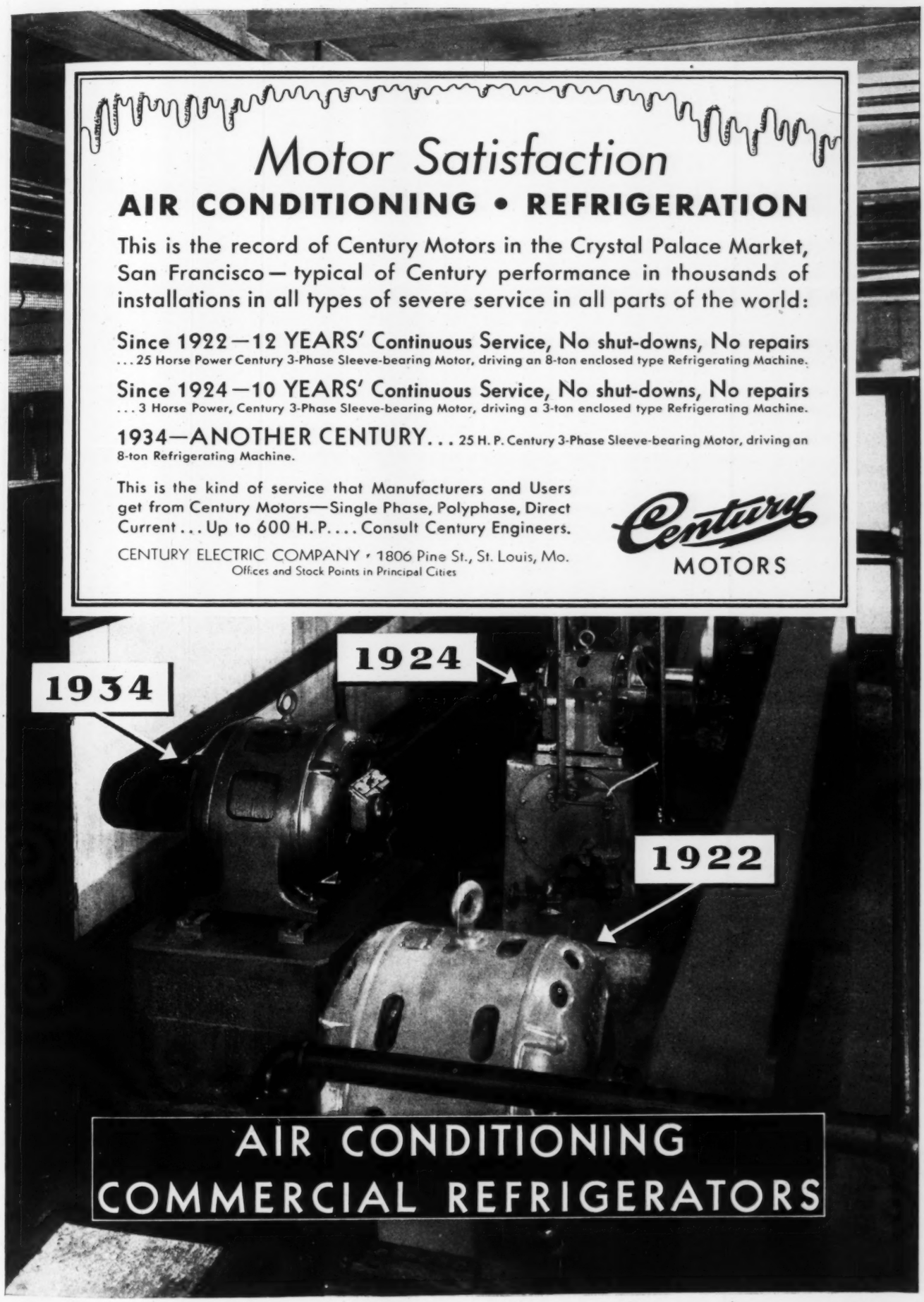

Motor Satisfaction
AIR CONDITIONING • REFRIGERATION
This is the record of Century Motors in the Crystal Palace Market, San Francisco — typical of Century performance in thousands of installations in all types of severe service in all parts of the world:
Since 1922—12 YEARS' Continuous Service, No shut-downs, No repairs
... 25 Horse Power Century 3-Phase Sleeve-bearing Motor, driving an 8-ton enclosed type Refrigerating Machine.
Since 1924—10 YEARS' Continuous Service, No shut-downs, No repairs
... 3 Horse Power, Century 3-Phase Sleeve-bearing Motor, driving a 3-ton enclosed type Refrigerating Machine.
1934—ANOTHER CENTURY... 25 H. P. Century 3-Phase Sleeve-bearing Motor, driving an 8-ton Refrigerating Machine.
This is the kind of service that Manufacturers and Users get from Century Motors—Single Phase, Polyphase, Direct Current ... Up to 600 H. P. ... Consult Century Engineers.
CENTURY ELECTRIC COMPANY • 1806 Pine St., St. Louis, Mo.
Offices and Stock Points in Principal Cities
Century MOTORS
1934
1924
1922
AIR CONDITIONING
COMMERCIAL REFRIGERATORS

CALENDAR OF MEETINGS AND EXPOSITIONS

Sept. 18-20—

Association of Iron and Steel Electrical Engineers.

Exposition of equipment and annual meeting to be held at Hotel Statler, Cleveland, will include papers on "Special Electrical Drives for Steel Cleaning and Processing Machines," by A. M. MacCutcheon and W. R. Hough; "New Developments in Lubrication," by G. W. Miller; "Recent Developments in the Welding of Aluminum Alloys," by D. I. Bohn; "Oxy-Acetylene Welding and Cutting in Metal Working," by W. S. Walker; and "Individual Motor Drives for Run Out Tables and Coilers—Dynamic Braking through Direct Current," by F. E. Harrell and C. V. Gregory. John F. Kelly, 1010 Empire building, Pittsburgh, is managing director.

Sept. 19-29—

National Electrical Exposition.

To be held at Madison Square Garden, New York. Ralph Neumuller, Electrical Association of New York, Grand Central Palace, New York, is general manager.

Sept. 22-27—

American Transit association.

Exposition of equipment and annual meeting to be held in the Public Auditorium, Cleveland. Guy C. Hecker, 292 Madison avenue, New York, is secretary of the association.

Oct. 1-5—

National Safety council.

Exposition and annual meeting to be held at the Cleveland, Statler, Carter and Hollenden hotels, Cleveland. W. H. Cameron, 20 North Wacker drive, Chicago, is managing director of the council.

Oct. 1-5—

American Welding society.

Annual meeting to be held at Hotel New Yorker, New York, will include technical papers on "Use of Polarized Light as Applied to Welding Products," by E. W. P. Smith; "Impact Resistance of Welded Joints," by W. Spraragen; "Metal Spraying," by E. V. David; "Hard Facing,'" by B. E. Field; "Flame Machining"; and "Flame Cutting," by Bradley Stoughten. M. M. Kelly, 33 West Thirty-ninth street, New York, is secretary.

Oct. 1-5—

American Society for Metals.

Exposition and annual meeting at Commerce hall, Port of Authority building, New York, will include papers on "Alloys of Iron and Manganese, Part XIII," by F. M. Walters and Cyril Wells; "Malleable Castings," by Albert Sauveur and H. L. Anthony; "Properties of Some Cast Alloy Steels," by T. N. Armstrong; "Factors Determining the Impact Resistance of Hardened Carbon Steels," by Howard Scott; and "Ductility of Chromium-Nickel Austenitic Steels at Elevated Temperatures," by H. D. Newell. W. H. Eisenman, 7016 Euclid avenue, Cleveland, is secretary.

Oct. 1-5—

American Society of Mechanical Engineers.

Fall meeting of Iron and Steel division to be held at Hotel Pennsylvania, New York. P. T. Wetter, 29 West Thirty-ninth street, New York, is assistant secretary.

Oct. 1-5—

American Institute of Mining and Metallurgical Engineers.

Fall meetings of Institute of Metals and Iron and Steel divisions to be held at Hotel Pennsylvania, New York. John T. Breunich, 29 West Thirty-ninth street, New York, is assistant secretary.

Oct. 8-13—

Brewery Supply and Equipment Exposition.

To be held at Grand Central Palace, New York. Information on the exposition may be obtained from Charles F. Roth, Grand Central Palace, New York.

Oct. 15-20—

Dairy and Ice Cream Machinery and Supplies association.

Exhibition of equipment and annual meeting to be held at Public Auditorium, Cleveland. C. E. Breece, 232 Madison avenue, New York, is secretary of the association.

Oct. 17-20—

National Electrical Manufacturers association.

Annual meeting to be held at the Palmer House, Chicago. W. J. Donald, 570 Lexington avenue, New York, is managing director.

Oct. 22-23—

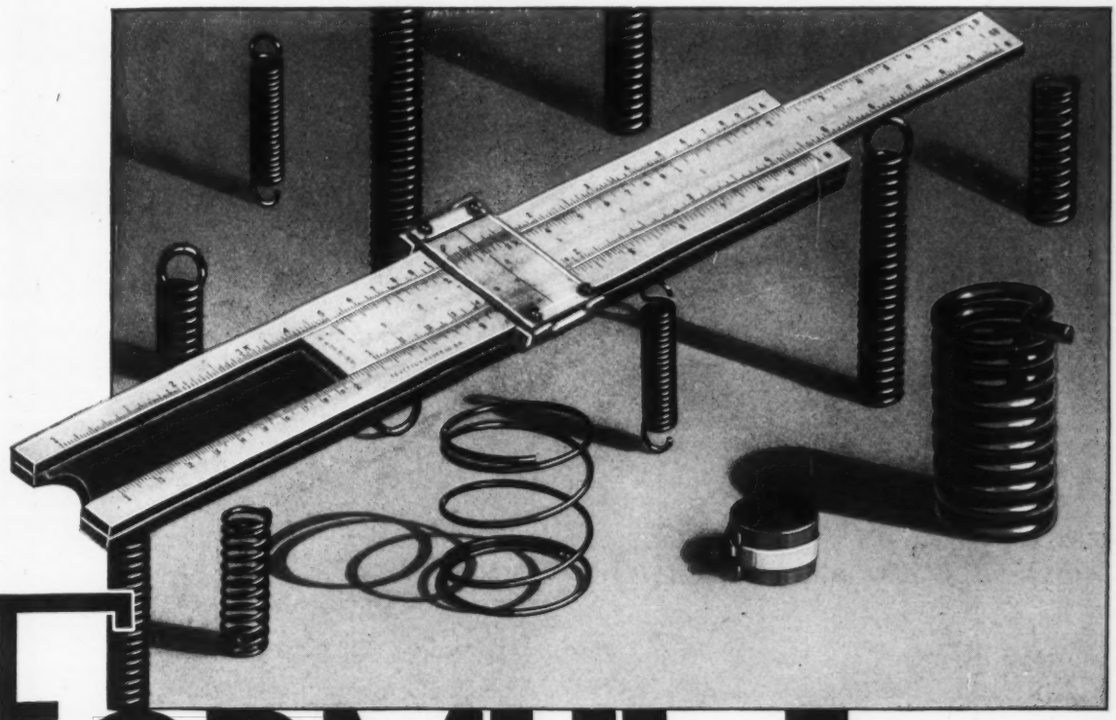
American Gear Manufacturers association.

Semiannual meeting to be held at The New Pfister, Milwaukee. J. C. McQuiston, Penn Lincoln hotel, Wilkinsburg, Pa., is manager-secretary.

Oct. 22-26—

American Foundrymen's association.

Annual meeting, exposition and International Foundry congress to be held at the Auditorium, Philadelphia. C. E. Hoyt, 222 West Adams street, Chicago, is secretary.



FORMULA "Can't BUILD THIS FACTOR INTO SPRINGS

EVERY known calculation regarding spring design and application may be carefully and accurately figured. No factor of tensile strength, corrosive resistance, stress, torsion, or endurance may be overlooked—and yet the spring may fail because one vital ingredient is missing. This ingredient is Fixed Quality—and it is a component part of every spring produced by the American Steel & Wire Company. Fixed Quality is the result of scientific coordination of knowledge, unexcelled manufacturing and technical facilities and over 100 years of wire making experience. It is your assurance, not only of perfect spring design, but of unfailing spring performance in the service your product renders. The facts back of Fixed Quality are most interesting —and we shall be happy to convey them to you.

American QUALITY Steel & Wire Company **SPRINGS**

1831 MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING 1934

AMERICAN STEEL & WIRE COMPANY

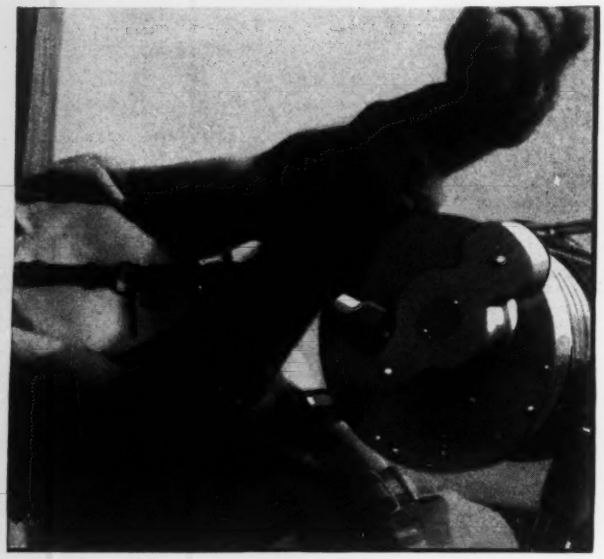
208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Building, New York
First National Bank Building, Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Bldg., San Francisco

Export Distributors: United States Steel Products Company, New York



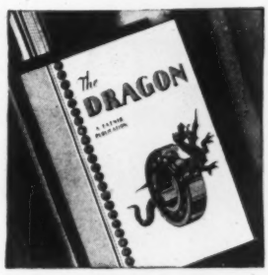
Even FISHING *is better with* FAFNIRS

Few think of a fishing reel as a machine subjected to severe punishment. But, consider a 700-pound fighter travelling away with the line at 40 miles per hour. A thrill, to be sure, and a severe strain too on the reel bearings which at this speed revolve at from 3,000 to 4,000 r.p.m.

Frequent lubrication is the practice when plain bearings are used in playing a single fish. Even then the bearings get hot. With Fafnir Ball Bearings in the reel no attention is needed. All the effort is used in playing the fish.

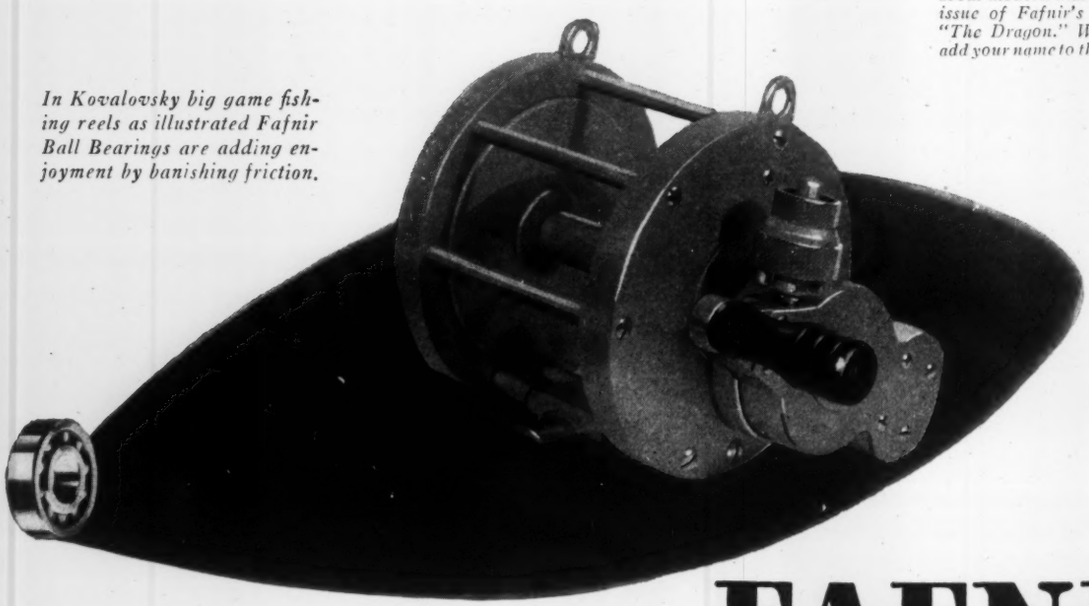
Whatever the fight may be, if friction is part of the fight Fafnirs will help win. They banish this time-and-power-consuming "undesirable." They assure "new machine" performance indefinitely, with no other maintenance than occasional lubrication.

THE FAFNIR BEARING COMPANY, *New Britain, Conn.* Atlanta . . Chicago . . Cleveland . . Dallas . . Detroit . . Milwaukee . . Minneapolis . . New York . . Philadelphia.



You will find interesting facts about modern machines in every issue of Fafnir's house organ, "The Dragon." We will gladly add your name to the mailing list.

In Kovalovsky big game fishing reels as illustrated Fafnir Ball Bearings are adding enjoyment by banishing friction.



FAFNIR BALL BEARINGS

MACHINE DESIGN
THE JOHNSON PUBLISHING CO., CLEVELAND, OHIO
September, 1934 Vol. 6—No. 9

Pitfalls Await the Unwary in Assigning Patents!

By George V. Woodling

IT IS not safe, when dealing in patents, to follow the general rules governing other property. Patents are a peculiar species. They are not governed by the common law by which other property is usually governed, but by laws enacted by Congress. Therefore, no rights can be acquired in patents unless authorized, and in a manner prescribed, by the Federal Statutes.

Under the present law it is expressly provided that patents, or any interest therein, are assignable, without any restriction whatsoever; an equitable interest in a patent is likewise assignable.

If A, the owner of a United States patent, sells the patent to B, a manufacturing company, the transaction is generally referred to as an assignment, and B, the assignee, acquires what is legally designated as the *Entire Right, Title, and Interest to and Under Said Patent, Comprising the Exclusive Right to Make, Use and Vend the Invention Throughout the United States.* The assignee enjoys absolute freedom in the use or sale of the rights granted by the assignment. He may, in turn, assign the patent rights to another, and he to a third, and so on. The assignee acquires by the assignment only such title and rights as his assignor possessed. These rights are subject to all existing equities or conditions, such as licenses already granted under the patent, of which the assignor had actual or constructive notice. It has been held that the assignee must inform himself of prior licenses as best he can at his own risk.

An assignment does not of itself vest the right to further improvements under the patented device, but it may be made to transfer improve-

Copyright, 1934, by George V. Woodling

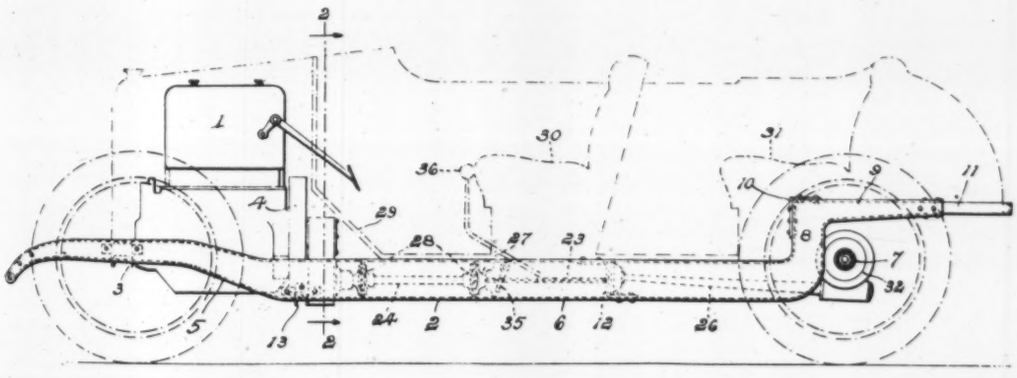


Fig. 1—Details of automobile chassis, disclosed in confidence, formed the basis for a suit relative to appropriation of invention

ment of a patent. These transfers have, however, certain limitations in that they include only improvements on the particular machine or device protected by the patent.

Also, an assignee acquires the right to sue infringers in his own name; but, unless otherwise specified, an assignment does not include the right to damages for infringements occurring prior to such assignment. However, there is

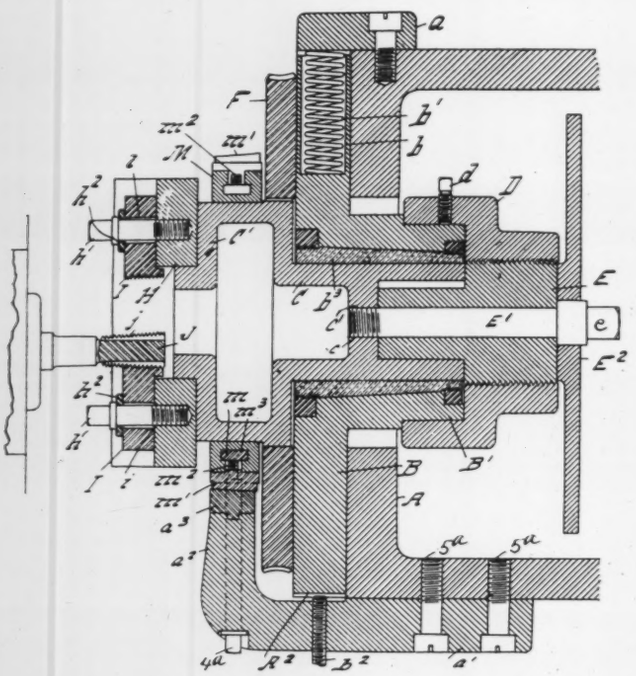


Fig. 2—Action in connection with suing for infringement must be brought in the name of the patent owner

some authority to the contrary. A claim to recover profits or damages for past infringements cannot be severed from the title and sold separately by assignment or grant to another person who may desire to sue the infringer for past infringements as was held in connection with the mechanism of *Fig.* 2. The action must be brought in the name of the owner of the patent.

May Sell Part of Patent

In the preceding illustration, had A, the owner of the patent, sold to B, the assignee, something less than the whole patent, the transaction would be, nevertheless, an assignment. However, the rights acquired by the assignee are legally designated as *An Undivided One-tenth Part* (as the case may be) *of the Entire Right, Title, and Interest to and Under the Patent, Comprising the Exclusive Right to Make, Use and Vend the Invention Throughout the United States.* A and B, who now are the joint owners of the patent, are not partners as the law recognizes partners in a common venture. They are at each other's mercy. B, the manufacturing company, which owns only an undivided one-tenth part, may manufacture and sell the patented device, and reap large profits, without giving A, the other co-owner, one cent. There is no accounting of profits.

Each Owner Has Individual Rights

In the absence of a separate partnership agreement, each co-owner may manufacture, use and sell the patented inventions with or without the consent of the other. This is because the use of the invention by one of the co-owners is not the exercise of the entire monopoly covered by the patent. It is merely the exercise or use of his individual right and is not exclusive of the rights of the other assignees. The separate rights of the other co-owners remain unaffected by such use and thus each is free to use the invention in all legal ways for his own profit. As either co-owner may separately grant licenses to competing manufacturing concerns, it is a good policy when acquiring patents to make certain that the title acquired is the entire right and not an undivided part of the entire right. In the latter case there is no way to control the patent monopoly as against competitors who may acquire rights under the same patent from another co-owner.

By a separate agreement between the parties the patent may be held in partnership like other property wherein the mutual rights and liabilities of the partners are determined by the agreement and the general law of partnerships. In this way a partnership could be created wherein the inventor of a machine assigned one-half interest in a patent in consideration of the other party advancing money to enable him to apply for and obtain the patent, and wherein it also was stipulated that neither of the partners should sell his interest in the patent without first offering such interest to the other, and that each should have a specified interest in the patent and all monies derived from the sale and exploitation of the invention.

Inasmuch as a separate partnership agreement between various co-owners may not bind licensees under the patent without notice, it is usually best that the co-owners transfer the entire right, title and interest to themselves as joint trustees, or to a single trustee clothed with the proper authority to manage the trust to the best interests of the separate co-owners.

Number of Co-owner's Unlimited

There is no limitation in the United States on the number of persons who may be co-owners of a patent through assignment. Also, two or more persons may be joint owners of a patent by reason of the fact of joint inventorship.

It has been held, in relation to the seed planter *Fig.* 4, that the issuance of a patent to T and L of the firm of T & L puts the legal title in the

parties jointly, and not in the firm. Where the legal title to a patent used in the business of a firm is in the partnership jointly, an assignment by one partner to the other of all goods and machinery and all other property whatsoever belonging to the firm, and all his rights, title and interest therein does not convey legal title to the patent.

Determine Inventor's Rights

Usually the case of joint ownership arises where the inventor has insufficient funds to complete and reduce his invention to practice, and calls upon someone to finance the situation in consideration of the inventor assigning an undivided portion of the invention. Therefore, when an invention is submitted to a company it is a good policy to inquire first as to whether or not the inventor has the full right to convey the entire right, title and interest to his invention before spending too much time or money investigating the engineering and commercial merits of the submitted device. Invariably in such cases it turns out that the inventor has assigned or has given certain rights to others, and that it becomes necessary to deal not only with the inventor, but also with others who have acquired rights. If the inventor is unwilling to show that he has full rights, the best thing to do is to terminate all relations, because if he is acting in good faith he should not be reluctant to show that he has good title. It is advisable before acquiring rights to a patent under an assignment to make a search in the assignment records in the Patent Office. This will indicate whether or not the inventor has made any prior recorded assignments.

A portion of section 4898 of the patent laws specifies that:

> "Every patent or any interest therein shall be assignable in law by an instrument in writing, and the patentee or his assigns or legal representatives may in like manner grant and convey an exclusive right under his patent to the whole or any specified part of the United States. An assignment, grant, or conveyance shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice unless it is recorded in the Patent Office within three months from the date thereof or prior to such subsequent purchase or mortgage."

Therefore, an assignment which is not recorded in the Patent Office is not valid against subsequent bona fide purchasers for value without notice. However, the assignment even though it is unrecorded is valid as between the parties thereto, and is likewise good against all subsequent purchasers who had actual notice. Under recent holdings, it was decided that this statute does not require the recording of an assignment within three months as a prerequisite to its validity. Hence, an assignment which is recorded after the three months' period has elapsed from the date of the assignment constitutes constructive notice to all persons acquiring an interest in the invention subsequent to its being recorded.

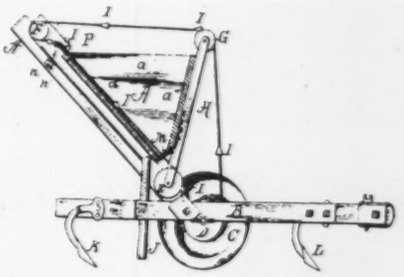


Fig. 4—The issuance of a patent to two men jointly puts the legal title in the parties jointly and not in partnership

TERRITORIAL ASSIGNMENT OF PATENT

Whereas I, John Doe of Cleveland, county of Cuyahoga, State of Ohio, did obtain letters patent of the United States for an improvement in Machine Tools, which letters patent are numbered 1025647, and bear date the 10 day of August in the year 1921; and whereas I am now the sole owner of the said patent and of all rights under the same in the below-recited territory; and whereas Richard Roe of Indianapolis county of Marion, State of Indiana is desirous of acquiring an interest in the same:

Now, therefore, for and in consideration of the sum of 1000.00 dollars to me in hand paid, the receipt of which is hereby acknowledged, I, John Doe by these presents do sell, assign, and transfer unto the said Richard Roe all the right, title, and interest in and to the said invention, as secured to me by said letters patent, for to, and in the State of Indiana and for to, or in no other place or places; the same to be held by Richard Roe within and throughout the above-specified territory, but not elsewhere, for his own use and behoof, and of his legal representatives, to the full end of the term for which said letters patent are granted, as fully and entirely as the same would have been held by me had this assignment and sale not been made

Executed 20 day of September 1921

In the Presence of:

James Smith — John Doe

John Brown — Richard Roe

Fig. 3—Typical contract for territorial assignment of patents. The patent number used is ficticious

May Assign by Territories

In addition to assignments of the entire patent or of an undivided part, there is a third type of assignment. This is referred to usually as territorial assignment and covers the exclusive right to make, use and vend the invention through a specified part or territory of the United States. A typical territorial assignment is shown in *Fig.* 3. The monopoly granted by the patent laws is one entire thing and cannot be divided into parts, except only by territorial assignments. A single claim of a patent consisting of several claims cannot be assigned.

It is expressly provided by the patent statutes that the patentee, his assigns or legal representatives, may transfer an interest in or rights under a patent. Thus, a patent may be assigned

by the administrator or the executor of a deceased patentee, or by one of two administrators. When assignment is made by a corporation it should be duly executed by the proper officer authorized to enter into such agreements on behalf of the corporation.

Invention Assignable at Any Time

An assignment of the invention may be made before the issuance of a patent, as the rights of an inventor to his invention dates from the time when the invention was made and is assignable at any time. In making an assignment the invention must be clearly identified This may be done by setting forth the name of the invention, together with a brief description, as well as the serial number in case of a patent application, or the patent number in case the patent is issued.

It is noted in the foregoing that there may be three kinds of interest in assignments So-called assignment or transfer short of these interests is a mere license giving the licensee no title in the patent, and no right to sue at law in his own name for infringement of the patent rights. Whether a transfer of a patent right or interest under a patent is an assignment or a license depends not upon the name by which it is called, but upon the legal effect of its provisions and terms. Thus, an agreement by which the owner of a patent grants to another "the sole and exclusive right and license to *manufacture* and *sell*" the patented article throughout the United States (not expressly authorizing him to *use* it) is not an assignment, but a license.

Three Rights Are Covered

In a case of this type, had there been an express authorization to use the invention the agreement would have constituted an assignment. This is because the present law authorizes the granting to inventors, their heirs and assigns, of an exclusive privilege (1) to make, (2) to use, and (3) to vend their inventions for a definite period of time. Thus, a mere license is effected by the giving of (1) an exclusive right to *make* and *sell,* but not to *use,* (2) an exclusive right to *make* and *use,* but not to *sell,* and (3) an exclusive right to *use* and *sell,* but not to *make.* It is also manifest from the nature of the patent statutes that the right to manufacture, the right to sell, and the right to use, are each substantive rights, and may be granted or conferred separately by the patentee.

A valid express license need not be in writing, although from a practical point of view it is always advisable to reduce all licenses to writing because in this form they are much easier to prove in case of contest. If the license is in writing no particular form is necessary, nor need it be recorded in the Patent Office, as there is no authority or provision for recording licenses in the Patent Office. It must, however, conform to the requirements of state laws and not be in restraint of trade or against public policy.

When the patentee gives a license only to one individual or corporation, or other legal entity, it is generally termed an *exclusive license.* On the contrary, when the patentee gives a license to several individuals, or to several corporations or several legal entities, the license is generally termed a *nonexclusive license.* Even though an exclusive license gives the patent monopoly to one legal entity, it has been held that it is not illegal in restraint of trade.

In exclusive licenses, based upon royalties, the licensor in order to protect his rights fully, and to make certain that the licensee will continue to market and sell the patented invention, should seek a minimum royalty payable each year even though the licensee does not manufacture and sell any of the patented devices. The next best thing for the licensor is to specify that in the event the royalties accruing to him during any calendar year does not amount to a specified sum he may terminate the license agreement upon a specified number of days' written notice delivered to the licensee. In such provisions it is also usually specified that if the licensee makes good the deficiency prior to the expiration of the said specified period the agreement may continue.

Should Provide for Prosecution

Inasmuch as the license does not give the licensee a right to sue in his own name, there should be some provision concerning the licensor's right to prosecute infringers. In such cases the patentee gives and grants to the licensee the right to sue in the name of the patentee, or in the name of the licensee, or both, any alleged infringers of the patent. It is a good thing, however, for the patentee or licensor to reserve the right to be represented by counsel. This precaution is sometimes taken because the licensee may purposely make a weak showing to have the patent invalidated, in which case the rights of the patentee, or licensor, are lost.

In acquiring a nonexclusive license, precaution should be taken to insure that the license contains what is normally termed "a more favorable clause", in which the licensor agrees that if he shall, during the life of the license, grant another license of similar scope and character under the same patent on terms more favorable than those provided in the license agreement, he will promptly notify the prior licensee and furnish a copy so that the licensee shall have the option within a certain specified time of entering into a similar or more favorable term agreement with the licensor. In those cases where the owner of a patent is the manufacturer of the patented device, and desires to grant licenses

(*Concluded on Page* 60)

SCANNING THE FIELD FOR IDEAS

MACHINES which merely do the chore assigned to them without regard to other possible tasks, compactness or appearance are far from the ideal in design, no matter how efficiently they may operate. Thoroughgoing design often advances well beyond the immediate object. It may combine many units into one, increase the possibilities of use of the machine, consider the human element, enhance appearance and assure compactness without reducing efficiency.

Design of this type is ably represented by the Thor electric servant, *Fig.* 1, built by Hurley Machine Co. A modern washing machine forms the basis for the development, but as can be seen from the illustration the usual appearance has been completely concealed by the square, enameled frame with black trim around the base where mopping might mar the appearance. Corners are Eraydo metal, top monel metal.

The unit can be conveniently used as a kitchen table whenever the washer is not in use, the material of the top making it a satisfactory mixing surface. Further, the plug in the right rear corner conceals a splined shaft on which an ironer or a mixer can be placed in addition to the wringer for washing.

Fig. 1—*Domestic machine for washing, ironing and mixing has built-in radio*

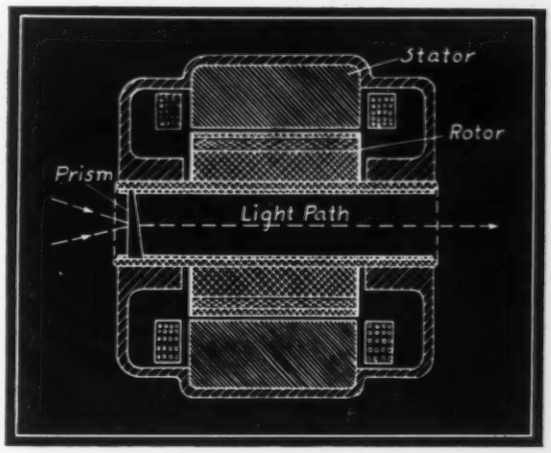


Fig. 2—*Hollow shaft motor simplifies mounting of small rotating prism in optical system*

However, the design does not stop with these innovations, as the unit is wired for radio and has an extra convenience outlet that will permit the attachment of other electric appliances, which may be placed on the table top. In models that have been designed but are not yet in production the radio, thoroughly insulated, becomes an integral part of the machine.

The mechanical efficiency of the machine is well advanced in that the timing unit on the front permits operation of the washer for the exact length of time needed to wash the type of cloth in the machine. Also, the use of the washing machine motor for other jobs gives a ¼-horsepower motor for the mixer.

UTILIZING MOTOR WITH HOLLOW SHAFT

WHEN a color analyzer was being developed recently the designers showed particular ingenuity in utilizing a hollow shaft motor, *Fig.* 2. They found this construction to be the answer to a problem of obtaining high speed rotation of a small prism in the optical system of the device. Noise was reduced to a minimum in ad-

dition to simplifying operation and expediting color matches.

Prism is mounted on the inside of the shaft which has an internal diameter of nineteen millimeters. The motor, a shaded pole induction type, is self starting and operates at about 3200 revolutions per minute. Lamps are mounted in the form of a square, the reflected beam directed upward through the center of the square to the photometer. Subsequently, the light beam passes through the prism and the hollow shaft to the remainder of the optical system.

To obtain the same result with a standard motor would require that the prism be mounted in a separate rotating unit in the optical system, this unit probably being driven by belt or gears. The engineers declare that such a mounting in a small unit of this type always is attended with disagreeable noise and friction as well as being subject to wear. With the new mounting there is no load on the bearings other than normal friction. Bausch & Lomb Optical Co. built the machine.

PLATING OBVIATES PISTON SEIZURE

DEVELOPMENTS in finishes are moving rapidly. Tin plating now is being employed on pistons to obviate seizure. When a cast iron piston is tin plated properly, it is possible to fit it much closer than otherwise and to operate the engine immediately at practically full speed and power.

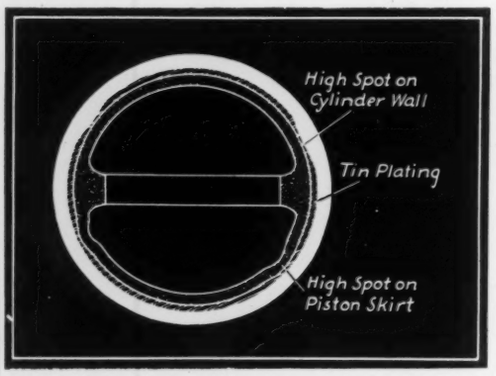


Fig. 3—Exaggerated sketch of piston and cylinder wall shows purpose of tin plating

In commercial practice it is well known that cylinders seldom are perfectly round, and even if made so, they are more or less distorted by temperature changes. Pistons also are subject to the same defects and are susceptible to distortion by temperature changes because the head portion normally reaches a temperature several hundred degrees higher than the lower part of the skirt.

The important advantages of tin plating are explained by the characteristics of tin as a bearing metal and the manner in which it acts on a piston in the working engine. Soft and plastic, the metal will yield at points of highest pressure before sufficient heat and pressure are developed to cause the piston to seize. After a short period of operation the metal has formed itself as indicated in *Fig.* 3 to compensate for the distortion of the piston and also that of the cylinder, forming conjugate surfaces between the two parts at their normal operating temperatures.

Tin has a valuable self-lubricating quality and a low coefficient of friction. Despite its softness, when electrically deposited it wears comparably to cast iron. In applying the tin plating, it is usual practice to grind the cast iron pistons for the conventional loose clearance, then build up the skirt to a tighter fit by the thickness of the tin deposit. A 3-inch cast iron piston for instance, is ground for the standard 0.003-inch clearance, or 0.0015-inch to a side. The piston then is electro-plated to a thickness of 0.00075 inch, leaving a final clearance of only 0.0015 or 0.00075 inch to a side. Thompson Products Inc., Cleveland, is leasing tin plating machines to wholesale automotive parts jobbers. This is under an arrangement with General Motors Corp., owner of the tin plating patents.

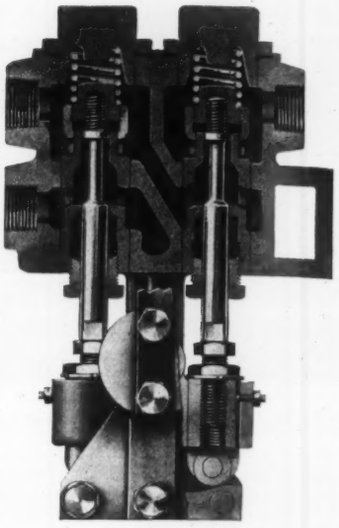


Fig. 4—A closely fitted sleeve around the valve seat and a close fitting plunger cuts off practically all flow of water as the valve stem moves downward with closing of device. Wire drawing or cutting of seating elements thus is prevented

PREVENTING WIRE DRAWING IN VALVES

BY EMPLOYING a closely fitted sleeve around the seat and a close-fitting plunger inside the neck of the seat or seat bushing, it has been possible in a newly designed hydraulic operating valve, *Fig.* 4, to cut off practically all flow of water as the valve stem moves downward with the closing of the device. Seating elements therefore, make contact with practically no water flowing, with the result that wire drawing or cutting of the seating elements is prevented. The ring of water between the two parts of the seating mechanism, formed prior to the closing of the valve, aids in cushioning the closing and

prevents hammering of the disk under action of high pressure water.

Sectional view of a three-way Homestead valve, *Fig.* 4, shows both inlet (right side) and cylinder (upper port on left side) valves in closed position, operating handle being vertical. If the operating lever is moved to the left the inlet opens and water passes to the cylinder. If moved to the right the exhaust valve opens and water passes from the cylinder down through the exhaust valve (lower port on left-hand side) and out through the exhaust line.

DESIGN TO ELIMINATE EXTRA PARTS!

NO DESIGNER consciously would make himself ridiculous by putting a part on his machine that had no reason to be there, yet the same man will design a machine requiring an extra prime mover when he could efficiently obtain his power from another part of the machine much more economically. Where space is at a premium, as is particularly true in mining machinery, the importance of eliminating extra parts is considerably increased. And in these applications economy does not end with the machine itself. For example, in carrying coal away from a shaker conveyor, it would be necessary that four or five cars be present at all times, and here extra expense could quickly wipe out profits.

In order to overcome the need for tieing up a locomotive in spotting operations, and yet be able to have sufficient car capacity in just the place it is needed, Goodman Mfg. Co has perfected a mechanical car puller which performs the spotting of cars without the need for any additional discharge trough support, extra electric motor or any other additional power device.

The puller consists of a hoist, a cross support for the trough and two roof jacks. The shaker conveyor trough is given a longitudinally reciprocating motion at its upper end. Power for moving the rope drum, from which the cable is attached to the cars, is furnished by the motion of the trough through rod *A*, *Fig.* 5. One end of this rod is connected to a bell crank *B*, which operates a vertical rod *C*. To the lower end of rod *C* is attached a second bellcrank *E*. In the lower arm of *E* there are three holes to enable the puller to be used with a variable stroke. On the upper arm of *E* there is a pawl *F* and a roller, which are held out of contact with the ratchet wheel *G* by means of cam *H*. Cam *H* is pulled aside by a rope which attaches to handle *J*, which rope is in the hands of the car trimmer. On the opposite side of the rope drum is another ratchet and pawl *K*. The pawl is stationary on this side and is so arranged that it prevents a reverse motion of the drum. The two jacks are of the ratchet type, while support for bellcrank *B* consists of two brackets on the upper end of which are two rollers which form a trough support.

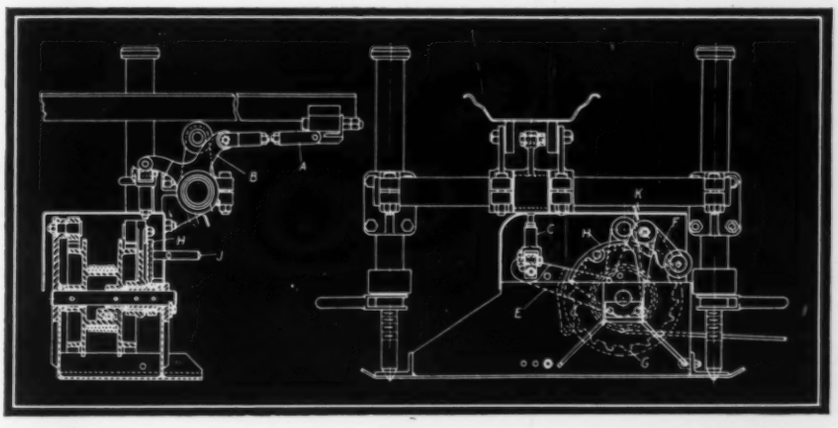


Fig. 5—Cars are spotted with this mechanical car puller which overcomes the need for tieing up a locomotive. No additional equipment is necessary in transporting coal away from a shaker conveyor

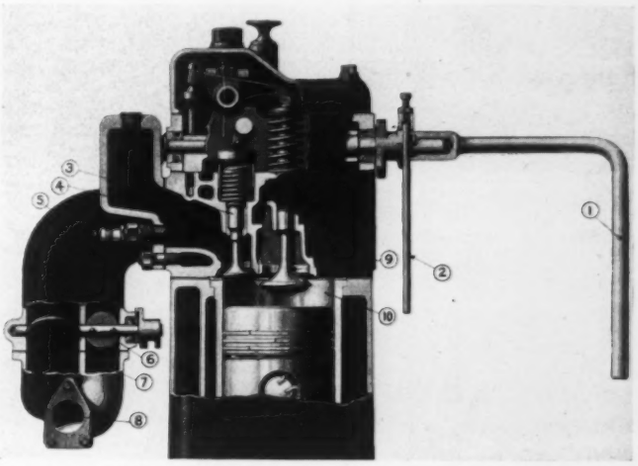


Fig. 6—Diesel starts as conventional low compression engine, then shifts automatically to high

IMPROVED DIESEL STARTING SYSTEM

BECAUSE cranking of a diesel requires three to four times the effort needed for a gasoline engine of corresponding size, an important problem is involved. Various new ideas to overcome this obstacle have been developed. The latest to appear is a starting system, *Fig.* 6, devised by International Harvester engineers for the new McCormick-Deering diesel. They decided it would be easier to provide a low com-

pression conventional type engine for starting even to the point of building it into the same diesel. The system automatically cuts out the carburetor, magneto, spark plugs and additional compression areas at the proper time and shifts the engine on to diesel without any concern on the operator's part other than throttling for engine speed.

Cutaway sectional view, *Fig.* 6, shows crank 1 for changing the engine. Numeral 2 designates the release rod and lock for holding the engine in starting position; 3 is the valve that connects the auxiliary combustion chamber 4; spark plugs 5 are located in the auxiliary combustion chamber; 6 is a double butterfly manifold valve; and 7 connects with gasoline carburetor at 8.

Previous engines used the spark plug in a valved chamber for igniting the spray from a diesel fuel nozzle until the engine became hot enough for auto-ignition but the carburetor was not employed. A later engine used a spark plug and carburetor with a half compression arrangement depending on a shifting camshaft for starting. When the engine was heated up the diesel mechanism was thrown in but the spark plug was not isolated and protected as in the McCormick-Deering diesel. Nor was low compression attained for carburetted fuel by the use of a valve auxiliary volume chamber. When the McCormick-Deering diesel has operated about one minute on gasoline the valve is closed automatically, compression immediately steps up to about 500 pounds and the engine runs as a diesel.

RUBBER IS BONDED TO BAKELITE

NEW ideas frequently call for new materials to attain their goal in design. One of the recent developments which offers engineers opportunities is the type of sheets of Synthane laminated bakelite and rubber. These materials are bonded together alternately to combine the extreme resiliency of rubber with the strength, rigidity, electrical as well as solvent-resisting properties of the product of the Synthane Corp. Number and thickness of the individual layers may be varied to produce a section of any given thickness or characteristics.

Possibilities of the new material readily suggest themselves, particularly where quietness and strength are significant factors. For example, it finds uses in vibration absorbing mountings for motors in electric refrigerators, washing machines and fans. Many other applications undoubtedly will be discovered.

EFFECTING ECONOMY WITH OVERDRIVE

CENTRIFUGAL force again has been utilized by engineers, this time in designing for economy in the cost of operation. Reference is made to its application in the overdrive mechanism which now is standard equipment on all Chrysler Airflow cars. The device, *Fig.* 7, is a compact, self-contained unit operating as a part of the conventional transmission. It is engaged automatically, by a centrifugal governor, by the driver taking his foot momentarily from the accelerator pedal at a speed of forty-five miles per hour or over and it disengages when the foot is removed from the accelerator at speeds below 37 miles per hour.

At forty miles per hour, with the overdrive engaged, a Chrysler Imperial obtained 16.9 miles per gallon, or two miles a gallon more than at twenty miles an hour in conventional drive. The overdrive is obtained with planetary gearing and the shift is accomplished by centrifugal weights. A sun gear is surrounded by five pinions mounted in a cage. Pinions mesh with an internal gear which is riveted to the

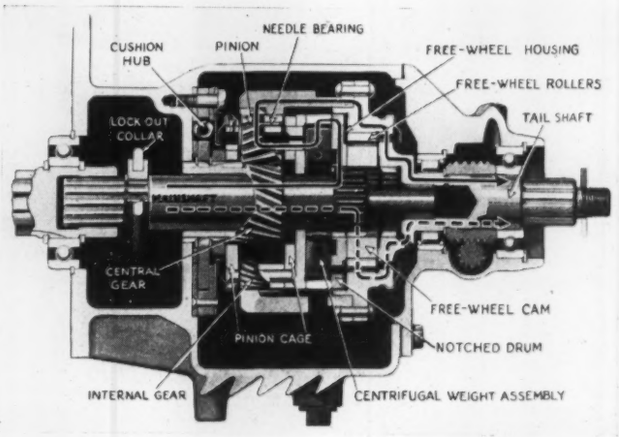


Fig. 7—Engagement of overdrive mechanism, utilizing centrifugal force, is governed by car speed

tailshaft assembly. A notched drum is attached to the pinion cage.

Each of two centrifugal weights is held inward by a coil spring until a speed of 45 miles per hour is exceeded, at which time centrifugal force overcomes the resistance of the springs and the weights tend to fly out. However, the outer surfaces of these weights are curved so that they cannot enter the notches as long as they are rotating faster than the drum. But the instant the foot is lifted from the accelerator pedal the engine, mainshaft and weight assembly slow down together. As soon as their speed reaches that of the drum the weights are able to insert themselves in the closely fitting notches, thereby locking the mechanism in overdrive.

Advantage of the overdrive mechanism in conserving engine life is apparent from the fact that it reduces engine speed thirty-five per cent for a given car speed. This means that a sixty-five miles an hour the engine is running at a speed corresponding to forty-five miles an hour in conventional direct drive.

Hydraulics Facilitates Propeller Adjustment

PROJECTED airplane flights into the stratosphere bring to attention the possibilities of the controllable pitch propeller. This, however, is only one aspect of its use. In everyday flying its record is imposing. So important has been the contribution of this mechanism to aviation that Frank W. Caldwell, chief engineer of Hamilton Standard Propeller Co., in June was awarded the Collier trophy for his design achievement.

The pilot of an airplane makes use of his controllable pitch propeller in much the same manner as an automobile driver shifts gears. Loss in engine power can be avoided by its use since the pitch can be adjusted to hold the engine to its rated r.p.m. and power output for takeoff and climb as well as for maximum speed and level flight. The ability to control pitch is particularly valuable in higher altitudes where variations in air density occur as the plane rises.

A cockpit control is installed to operate a three-way valve so arranged that rotation of the valve stem will cause the oil line leading to the propeller to be connected with the pressure supply in one position or with a drain into the crankcase in the other position. When this oil valve is thrown into pressure supply position, oil flows through a collector ring into the crankshaft and out into the pitch-operating cylinder *A*, *Figs.* 1 and 2, causing the cylinder to move forward on piston *C*. As the cylinder moves forward, a special ball bearing, *Fig.* 2, the outer race of which is attached to the cylinder, rolls in a cam slot in the counterweight bracket *D*.

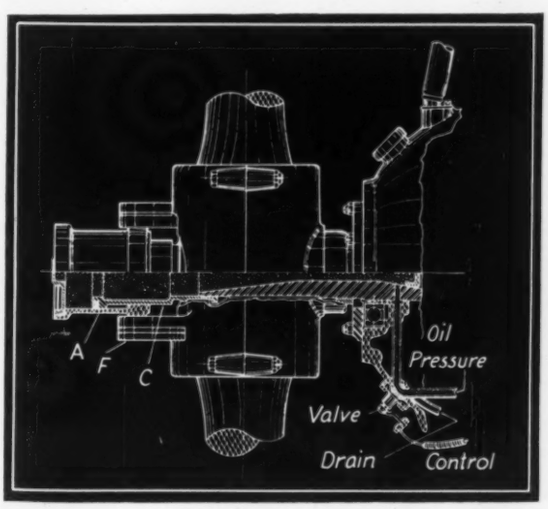


Fig. 1—Oil pressure moves cylinder A forward on piston, thus effecting change in propeller pitch

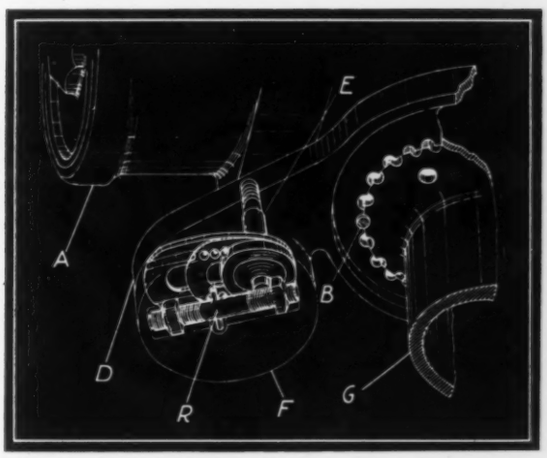


Fig. 2—Ball bearing rolls in cam slot in counterweight bracket

As the bearing rolls in this slot, it causes the counterweight to move toward the crankshaft axis, and as this takes place the propeller blade to which the weight is attached is forced into low pitch position. When the oil control valve is turned into drain position, oil from the inside of the cylinder is free to flow back into the crankshaft to the crankcase. Centrifugal force of counterweight bracket *D*, acting against the ball bearing in the cam slot, forces the cylinder *A* inward, thus causing the oil to be moved back into the case. At the same time, the counterweight bracket moves away from the axis of the crankshaft and causes the propeller blade to go into high pitch position.

Propeller blade bushings *G* in addition to being pressed into the blades, are provided with two pins and lock screws to insure solid attachment. Counterweight bracket *D* fits around the outside of the blade bushing and is held from end motion by a shim plate and the blade end. The inside of the counterweight bracket is provided with forty semicircular holes, and the outside of the blade bushing has thirty-six holes. This makes it possible to use four index pins *B*, *Fig.* 2, spaced 90 degrees apart, permitting indexing of the counterweight bracket relative to the blade in steps of one degree. This feature, together with the adjustment of the limit stop nuts in the counterweights, makes possible the selection of any desired high and low pitch blade angles within the pitch range for which the propeller was designed.

Phorograph Method Simplifies V

By M. F. Sayre

Associate Professor of Applied Mechanics, Union College

A SIMPLE and powerful alternative to the instantaneous center method in the study of relative velocities and forces in the different parts of a machine is through a graphical means sometimes spoken of as the phorograph method. This system, first described by Prof. Angus in his book on machine design, is a badly neglected method, and deserves much more attention from designers than it has received in the past. The present article describes a slightly modified form of Prof. Angus' method, with the proof especially considerably simplified.

In this method, some one part of a moving mechanism is selected as a reference link. This reference link might, for example, be the flywheel. The velocity of any desired point on the machine is then indicated by locating that point on the flywheel which moves in the same direction and with the same speed as the original point on the machine. Knowing the speed of the flywheel, the speed of the 'image' may be found and from it the speed of the original point on the machine. This statement may be best understood if we apply it immediately to a practical case. *Fig.* 2, for example, represents a walking beam mechanism connected to a crank and flywheel at *OA*.

In this figure, points *B'* and *D'*, marked on the flywheel, or rather on the flywheel imagined re-

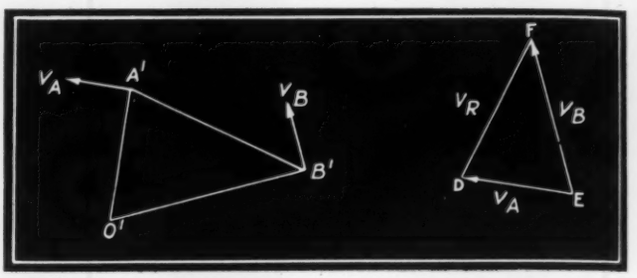


Fig. 1—*Proof of principle IV*

drawn to increased scale, have the same speed as points *B* and *D* on the walking beam. *E'* and *F'* on the flywheel have the same speed as *E* and *F* on the connecting rod, and so for each primed point. We may not know just what the speed of the flywheel is, but if the speed of the flywheel is doubled, the speed of each of the other parts is doubled also, so the position of the primed points stays the same. To get linear speeds, multiply the scaled radius out to the primed point by 2 π and by the RPM of the flywheel.

Parallel Lines Drawn

These points were found simply by drawing parallel lines. *A' B'* was parallel to *AB*. *C'* was at *O*, and *B'C'* was parallel to *BC*. *C'D'* was parallel to *CD*, and *B'D'* to *BD*, and so for each line, except that *O'F'* had to be made horizontal, not because *OF* was horizontal, but because the crosshead slide that *F* worked in was vertical.

The flywheel in this case is known as the 'reference link': i.e., the link to which everything else is referred. The primed letter points on the reference link are called the 'images' of the corresponding points on the real machine. This group of primed points, with the lines connecting them, is called the 'phorograph' of the machine.

The first step in each case is to select some one part of the machine as a reference link. It

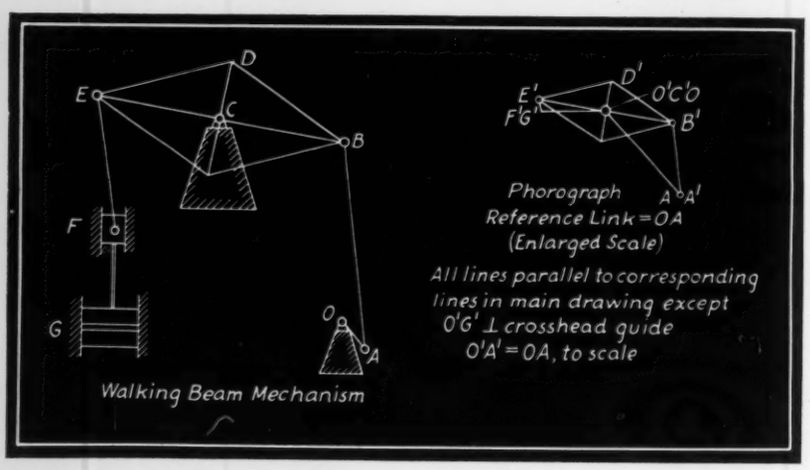


Fig. 2—*If speed of flywheel in walking beam mechanism is doubled, speed of all other parts is doubled also*

Velocity and Force Calculations

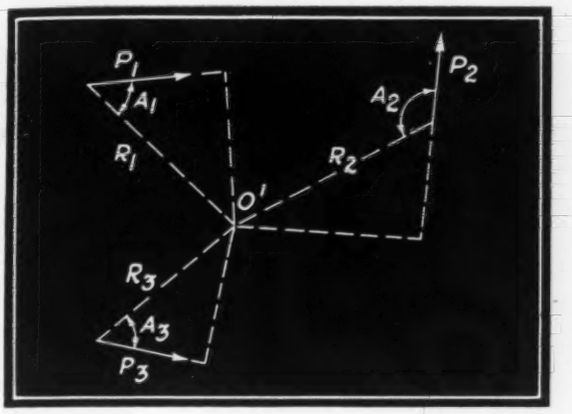


Fig. 3—Proof of principle VIII

must have motion of rotation, (not pure sliding motion) about some known axis, preferably fixed in position. Preferably, but not necessarily, the reference link should move at constant angular speed.

Two Principles Developed

Next mark, either on the reference link or for convenience on the reference link separately outlined to larger scale, all of the easily found images, remembering that in each case the image must be a point which moves with the same speed and in the same direction as the corresponding point on the machine. This leads to two simple principles:

I. The images of all stationary points on the machine are grouped at the center of rotation of the reference link.

II. The images of all points on the reference link must coincide with the points themselves.

Label all these points with the proper primed letter. Thus in the illustration given, O, O' and C' coincide, and all three letters are put down. Similarly, A and A' coincide.

Next comes a principle the proof for which will be given later.

III. The image of any line connecting two points both on the same link in the machine, will be parallel to the line itself. The image of any link, therefore, will be a figure precisely similar in shape to the link itself. It may be reversed in direction through 180 degrees, and it may be smaller or larger than the link itself, but it will always be similar in shape, and all dimensions will be proportional. Using this principle, once the image of any one side of a link is known, the image of the whole link can be drawn.

A special case is that of a link which has no rotary motion. Here the image of the whole link becomes infinitesimal in size; i.e. becomes a point.

Steps Are Outlined

A' and C' in *Fig.* 2 have already been located. Draw $A'B'$ parallel to AB, and $E'C'B'$ through C' parallel to ECB. Their intersection determines B'. Draw $B'D'$ parallel to BD, and $C'D'$ through C' parallel to CD, so locating D'. Draw $D'E'$ parallel to DE, locating E' by intersection with $E'C'B'$ already drawn.

Draw $E'F'$ through E' parallel to EF. Now

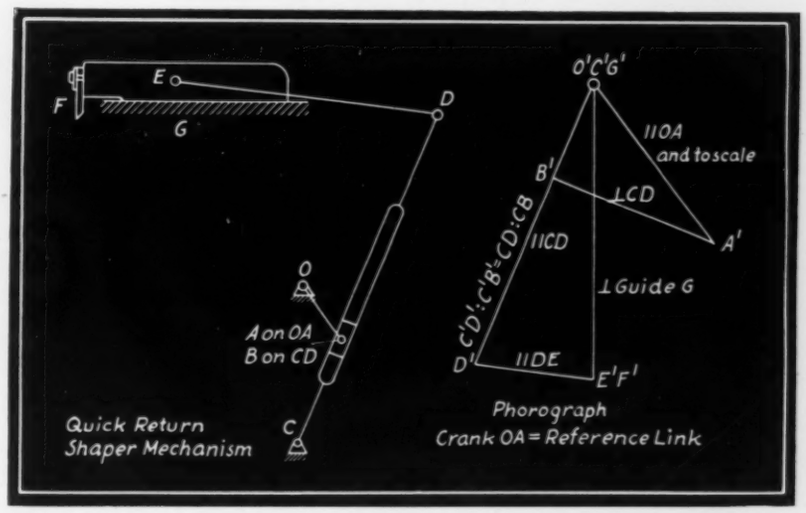


Fig. 4—At points of sliding contact it is often necessary to use two letters, one for each surface of contact

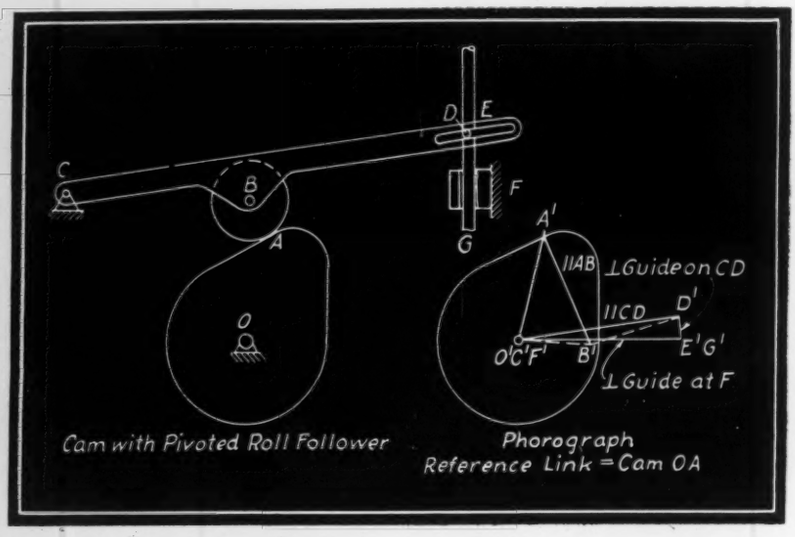


Fig. 5—Two points moving with relative parallel motion are connected by a line perpendicular to parallel surface

comes a snag. $C'F'$ cannot be drawn parallel to CF, because C and F are not on the same link. The principle of parallelism holds only when the two points connected are both on the same link; never, save accidentally, when they are not; and a new principle must be used.

> IV. The relative motion of any one point on the machine with respect to any other point whatsoever on the machine (not necessarily on the same link) is always in a direction perpendicular to the line connecting the images of the two points in the phorograph.

This general statement is a very broad one. In the specific case noted, the motion of crosshead F with respect to the body of the machine must evidently be in a direction parallel to the crosshead guides. By principle I, the image of all points on the stationary part of the machine are concentrated at O'. The image of F must therefore be on a line drawn through O' perpendicular to the crosshead guides. The intersection of this line with $E'F'$ determines point F'. Since the velocity of G is the same as the velocity of F, their images will coincide; i.e. G' is at F'. In similar manner, this principle will come into play when drawing a phorograph at practically all points where sliding action is present.

Used on All Types of Machines

By use of these four principles, phorographs, which are essentially modified velocity diagrams, may be drawn for virtually all types of machines. In fact, this is so generally true that failure of a phorograph diagram to connect properly may usually be taken as evidence that the machine itself is inoperative, either through self-locking characteristics or through absence of necessary links.

In *Fig.* 1, let A' and B' be any two images, on a reference link whose center of rotation is at O'. Then the velocity of A' will be $2\pi n \times O'A'$, where n is the speed of the reference link in RPM. Similarly, the velocity of B' will be $2\pi n \times O'B'$.

Draw a velocity vector triangle DEF with sides equal to V'_A and V'_B. The third side will be the vector difference of the two velocities, and so will be the relative velocity of B' with respect to A'. It will therefore also be the relative velocity of the original points, B with respect to A. The angle DEF will equal the angle $A'O'B'$ (sides DE and EF perpendicular respectively to $O'A'$ and $O'B'$).

By construction

$$\frac{DE}{EF} = \frac{2\pi n\, O'A'}{2\pi n\, O'B'} = \frac{O'A'}{O'B'}$$

The triangles themselves must therefore be similar, so that DF, or V_R, will be perpendicular to $A'B'$. The numerical value of the relative velocity may be found from the statement that

$$V_R = DF = DE \times A'B' / O'A' = 2\pi n\, A'B'$$

On the basis of this equation, principle IV may be amplified to read as follows:

Relative Velocity Line Perpendicular

> V. The relative velocity of any point with respect to any other point whatsoever on the machine is always perpendicular to the line connecting the images of the two points on the phorograph, and is numerically equal to the length of this line, multiplied by the angular velocity of the reference link in radians (or by $2\pi n$). If one of these points is stationary (point O'), absolute rather than relative velocities will be obtained.

As corollaries, the following statements may be made:

> VI. The velocity of any point A on the machine is to the velocity of any point B directly as the length of the radii $O'A'$ and $O'B'$ connecting their images with the center of rotation O' of the reference link.
>
> VII. The angular speed of n' of any link as AB at any one moment will equal the angular speed n of the reference link, multiplied by the ratio of the length of the image $A'B'$ to the original length AB.

Proof:

$$V_R = 2\pi n \times A'B' = 2\pi n' \times AB$$

Therefore

$$n' = n \times A'B'/AB$$

If the image $A'B'$ is reversed in direction to the original link AB, the angular motion of the link will be in reverse sense to that of the reference link, and vice versa.

The proof of principle III also results from principle V. If A and B are two points on the one rigid link, the distance AB will not change as the machine operates. The relative velocity of A with respect to B must therefore be in a direction perpendicular to AB. Since by principle V, this relative velocity is also perpendicular to $A'B'$, AB and $A'B'$ must be parallel. In other words, the image of any line connecting two points both on the same link in the machine, will be parallel to the line itself.

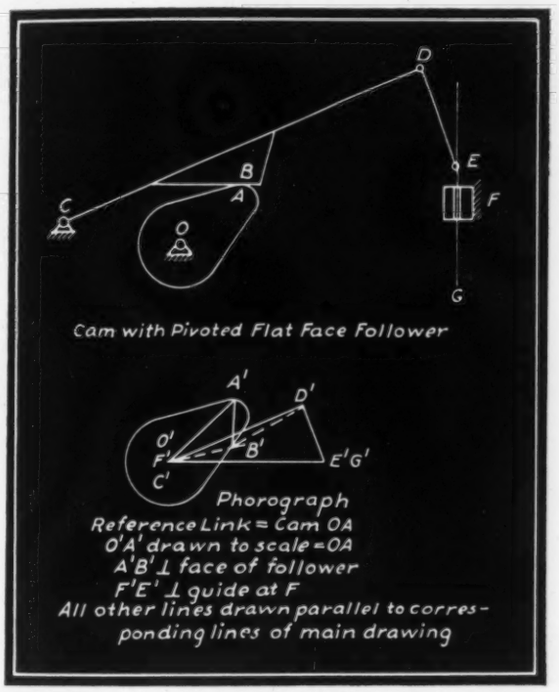


Fig. 6—Possible fields of application include a cam with pivoted flat face follower

Figs. 4 to 8 show typical phorographs of mechanisms selected with a view of showing possible fields of application. The shaper mechanism and the two cam mechanisms in figures 4, 5 and 6 are more or less self explanatory. Note only that at points of sliding contact, it is often necessary to use two letters, one for each of the two surfaces in contact. These two points are moving with different velocities, with a relative motion parallel to the contact surface, so that their two images will be connected in the phorograph by a line perpendicular to this surface.

In *Fig.* 7, the link CBE presents a different problem. Point E of this link is constrained to move horizontally, so that its image must lie on a vertical line through the center O'. The image of C must lie on a line through D' parallel to CD. Point B' must lie on a line through A' parallel to AB. These three conditions alone are not sufficient, until the further condition is added, that the image $C'B'E'$ must be similar to the original CBE, parallel to it and with all lengths proportional; i.e. $C'B'$ is to $B'E'$ as CB is to BE. Two or three trials will usually enable a line to be drawn which will satisfy this condition.

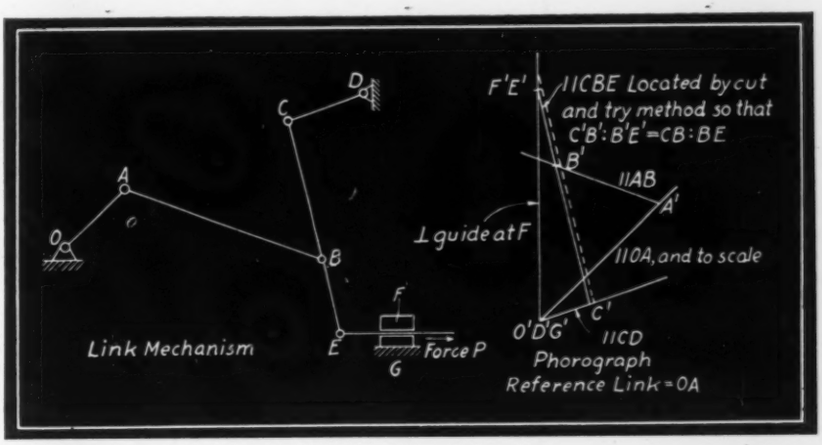


Fig. 7—Two or three trials will usually enable a line to be drawn that will satisfy the conditions

Gearing Problems Worked Out

Problems involving special types of gearing can sometimes advantageously be reasoned out with the help of a phorograph diagram. The planetary gearing of *Fig.* 8 is a good illustration. The significant points on this mechanism are the shaft centers D, E, O and A, and the points of tangency B and C of the pitch lines of the gears. Choosing OA as the reference link, the images of O, D, and E, and of the fixed point C all coincide at O'. $O'A'$ is drawn equal to OA to scale. Gears II and III operate as a single link, so that since points A' and C' have already been located, B' can also be found, using the relation $A'B'$ is to $A'C'$ as AB is to AC. On the basis of principle VII, the angular speed of the gear I and drive shaft E will be to the angular speed of the driven shaft O, as $E'B'$ is to EB. Further, since $E'B'$ is reversed in direction to EB, the rotation will be in the opposite sense. Here, as in other cases which may arise, a freehand diagram may be all that is needed, as it will furnish a basis upon which an analytical solution may be carried out.

According to the law of conservation of

energy, the energy put into a machine per second by the source of power must equal the energy delivered by the machine, plus that used in accelerating the machine parts or in elevating the machine parts, plus that lost in friction.

For any individual force, the energy input per second equals the velocity of the point of application of the force, multiplied by the effective component of the force, in the direction of the velocity. Indicate on the machine itself the various forces acting, and then transfer these forces parallel to themselves to the phorograph, letting them act through the images of their

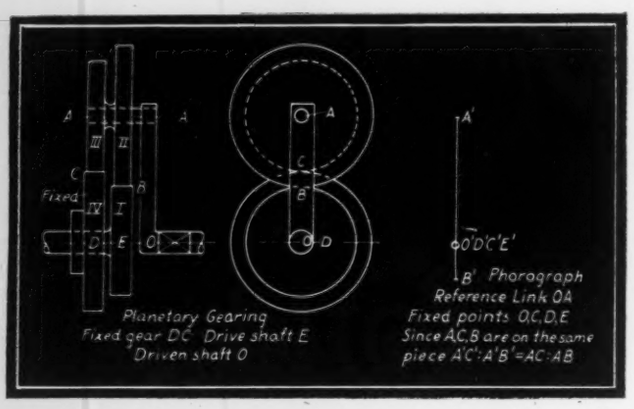


Fig. 8—A freehand drawing may be all that is needed to solve problems in planetary gearing

true points of application, as shown in *Fig.* 3. Draw radii from these images to the phorograph center O' and let these radii R_1, R_2, R_3 make angles A_1, A_2, A_3 with forces P_1, P_2, P_3 respectively.

The effective component of force P_1 will be $P_1 \sin A_1$, and the velocity of its point of application will be $R_1 \omega$ where ω is the angular velocity of the reference link in radians. The energy input per second will be the product of these two terms. But, as indicated in *Fig.* 3, $P_1 R_1 \sin A_1$ equals the static moment of the force about the center O'. The energy input of the force therefore equals this static moment, multiplied by the angular velocity of the reference link. For equilibrium, the summation of these energy inputs over the machine must equal zero. Since the angular velocity of the reference link appears in all terms, it may be divided out, resulting in the following principle:

> VIII. Transfer all external forces from their actual points of application to the images of these points, and consider them to act on the reference link itself. Take moments about the axis of the reference link. If the machine is in equilibrium, the sum of the moments of these forces will equal zero. Conversely, if the machine can be assumed to be in equilibrium, and all the forces but one is known, that force can be solved for.

This method can also be extended to include the determination of torque in shafting and in some cases to internal stresses in tension or compression parts. In *Fig.* 7, for example, the torque in shaft O equals the force P multiplied by its lever arm $F'O'$. The stress in AB equals this torque divided by the lever arm measured from O' perpendicular to $A'B'$.

By use of a modification of this method, accelerations, to be covered in a later article, as well as velocities may be determined. This is inherently a more difficult problem, as at any point both the normal and tangential components of the acceleration may come into play. In solving for these, a preliminary freehand solution by the graphical method may help materially in pointing toward the selection of the least complex of various analytical methods, or alternatively a complete graphical solution may turn out to be the best one to use.

They Say—

"It should be remembered that management and industrial engineering are historically children of mechanical engineering, that they are now well established fields in their own right and still growing rapidly, and that an engineering training always has been, and still is the best sort of background with which to enter upon these important and attractive careers."—Dr. Harvey N. Davis.

□ □ □

"He is the best educated who can make the best decision at the time it must be made. But we must get the feel of our work. We must know how to do the right thing almost instinctively. The mistakes we have made in recent years were the results of bad thinking back along the line."—Charles F. Kettering.

□ □ □

"In any depression the complexity of the problem is so great and the amount of available data so meager that the value of the scientific method of solution almost wholly disappears, or may even deceive us into believing that the results claimed have a merit which is not at all justified by a more careful and impartial examination of the facts."—Dr. Irving Langmuir.

Acceptance of the new streamlined high speed train is confirmed by the news that Budd in Philadelphia has orders for this type of rail equipment from two railroads, one in the East and the other in the West. This announcement recently was made by Edward G. Budd, president of the company which received a second order from the Chicago, Burlington & Quincy now operating the Zephyr.

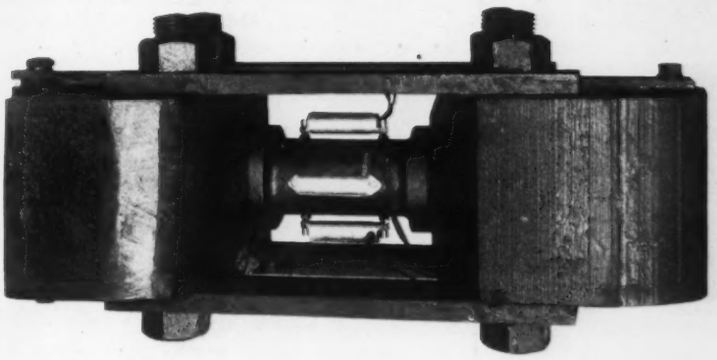


Fig. 1—Special coupling used as dynamometer measures tractive effort of an electric locomotive

Determining Design Accuracy by Oscillograph Tests

By E. L. Piper
Engineer, Westinghouse Electric & Mfg. Co.

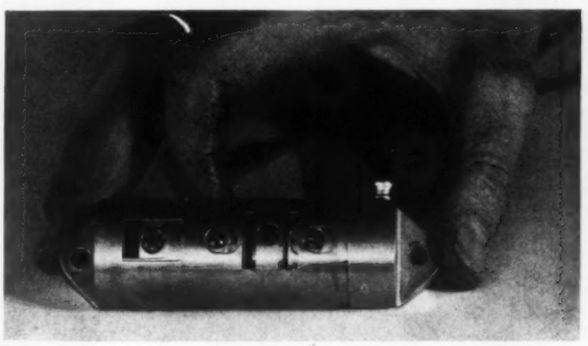
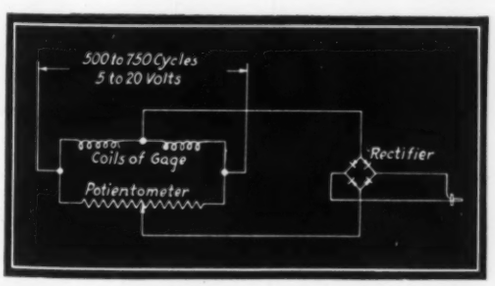


Fig. 2—Strain gage used with oscillograph for recording transient stresses

Fig. 3—Diagram of connections for a typical strain gage circuit used in testing



IN THE past, the electro-magnetic oscillograph has been one of the most valuable aids to the engineer in his study of the behavior of new apparatus. It has simplified the problems of development by recording instantaneous phenomena neither visible to the eye nor capable of being measured by the usual meters. Today we find that the oscillograph has not been discarded as an instrument which has outlived its usefulness, but is being used more frequently as new fields of application have been developed.

Most persons are familiar with the oscillograph as an instrument for recording purely electrical quantities. The adaptability of the oscillograph as a recording instrument in this field is nearly unlimited. By providing the necessary transformers and shunts, currents and voltages of practically any value can be recorded.

The more recent applications of the oscillograph have been as an instrument for recording mechanical movements, stresses, pressures, and accelerations. The oscillograph of course is an instrument for measuring electrical quantities, and in order to record any of the foregoing phenomena these quantities first must be translated into proportionate electrical values.

The magnetic strain gage shown in *Fig.* 2 makes use of the fact that within the elastic limit of most materials the elongation or compression of the material can be converted into terms of stress. This, when used with the oscil-

lograph, has proved to be valuable for changing strain into proportionate electrical values and recording them for permanent record. The magnetic gage consists of two coils wound on "U" shaped punchings as pole pieces. These pole pieces are attached to the main or fixed part of the gage. The armature is placed between the two pole pieces but is attached to the movable part of the gage. When mounted for tests, the gage is adjusted with an air gap between the armature and the pole pieces. The electrical circuit shown in *Fig.* 3 consists of a bridge circuit which is balanced before the test, when the armature is in the mid-position of the air gap. Any strain in the test piece on which the gage is mounted will move the armature in the air gap. This of course will unbalance the bridge by changing the reluctance of the circuit and cause current to flow in one of the coils, depending on whether the applied force is tension or compression. This current is measured by the oscillograph and is proportionate to the movement of the armature.

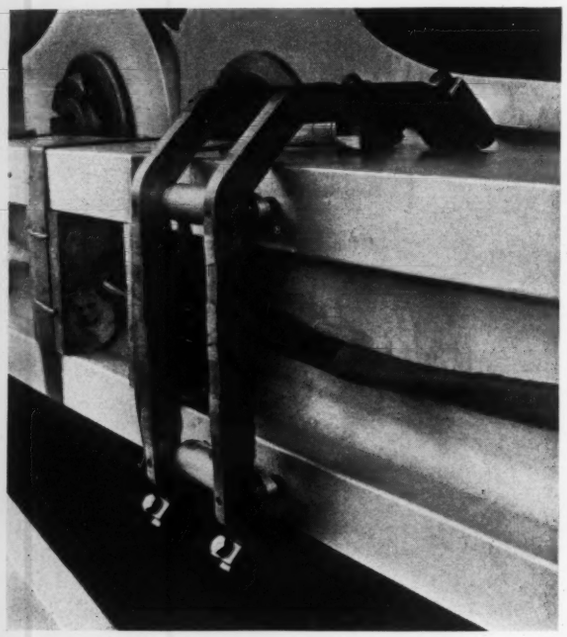


Fig. 4—Six strain gages mounted on the main drive rod of a steam locomotive indicate stresses

The magnetic gage is calibrated by mounting on a calibrator and moving the armature a known distance (measured by a dial-type micrometer gage) and measuring the deflection of the oscillograph element produced by the change of current. We know the modulus of the material under test and the strain necessary to deflect the oscillograph element a known distance. Therefore, the calibration can be reduced to pounds per square inch stress per inch deflection on the oscillograph. Several points over the range of stress expected during the test can be taken and as long as the armature does not hit the pole pieces the relation between the movement of the armature or the strain, and the change of current, will be proportionate. Variations of the circuit shown in *Fig.* 3, depending on the type of record desired, can be used. The most desirable record is obtained by using the double wave rectifier, as shown, with a damped vibrator in the oscillograph. This will give a straight line record and prevent overlapping when taking several records on the same film.

This combination is used when the frequency of the stress is not more than 15 or 20 cycles, for at higher frequencies the damped vibrator will not follow correctly. For measuring stresses of higher frequencies the envelope of the 500 cycle wave can be used, or the rectified wave can be filtered by means of a tuned circuit or choke allowing the ordinary frequencies to pass.

Applications Are Indicated

Some of the more recent applications of the strain gage and the oscillograph as a means of recording stress are shown in the accompanying illustrations, *Figs.* 1 and 4, indicating the wide field of application. It is interesting to note the large number of simultaneous records it is possible to obtain, as the only limiting factor is the number of oscillographs available.

A series of tests further illustrating the adaptability of the oscillograph was a study on railway air conditioning equipment. In addition to measuring purely electrical quantities, at various times the following nonelectrical records were made:

(a) Lateral and vertical accelerations of an axle mounted generator—Accelerations were measured by an instrument similar to the strain gage in principle of operation except that the armature of the accelerometer is mounted on a spring-supported mass, the natural frequency of the mass being three or four times the frequency of the acceleration measured.

(b) Head pressure of the compressor—This was measured with the aid of the Peters Telemeter.

(c) Rate of air flow through the fan—This was measured by means of electrical contacts on the hands of an anemometer.

(d) Train speed was recorded by means of a magneto driven from the car axle, the voltage output being directly proportional to the speed.

An important feature of these tests was that since the quantities to be recorded in the majority of cases were of low frequency, a slow film speed could be used through the use of the 200-foot film holder. Complete performance records of the equipment were obtained on one 200-foot film over the entire distance of a 295 mile run. Total time involved was 6½ hours.

The practical application examples of the oscillograph and its auxiliaries outside of the purely electrical field should give an idea of its increased usefulness and versatility.

Lure Sales with New Design!

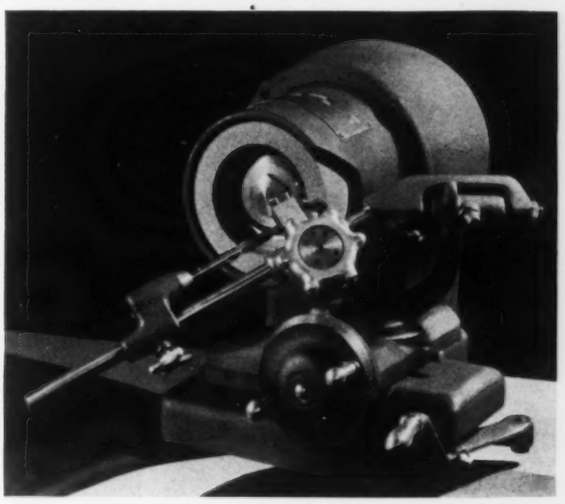


Fig 1—Built-in motor lends grace to appearance

OF THE thousands of machines introduced each year the majority go into highly competitive markets. This condition has become complicated to the extent that profits often are held to a minimum because of the amount of money that must be expended in sales effort. It is the virgin fields that yield the most lucrative returns and offer the greatest possibilities. By studying the requirements of the consumer in industry, in the commercial world and in the home, engineers will find promising outlets to which their ingenuity can be profitably applied.

An individual case in point which serves to illustrate this thought is a new bench type grinder, *Fig.* 1, for reclaiming drill of 1/16 to ½-inch diameter. Its field is not as extensive as that of, for instance, air conditioning, but the example serves extremely well. Sellers engineers in Philadelphia saw the need for this size and type of machine in a section of industry that continued to tolerate waste. In the past this range of drill sizes was either ground by hand if a skilled operator was available, or as was frequently the case the tool was discarded when broken or dulled.

To co-ordinate efficiency, appearance and economy in the design of the machine, the engineers recruited the possibilities of new materials and parts now available. Chromium plating (M. D. July) was adopted to overcome wear. Inasmuch as abrasive dust from the grinding is apt to work into the moving parts of the clamping mechanism; parts *A, B, C* and *D, Fig.* 2, are plated. These pieces are die castings, the use of which is an innovation in machine tool design and an important item in effecting economy. Appearance is enhanced and noise and vibration are held to a minimum by the use of an inbuilt motor integral with the base. The grinding wheel is mounted directly on the end of the motor shaft.

Because small drills are delicate and difficult to handle it was imperative that the machine be easy to control and precise in its operation. This called for a chuck, *Fig.* 2, that would permit rapid clamping, unclamping and precision grinding. If these could not be accomplished

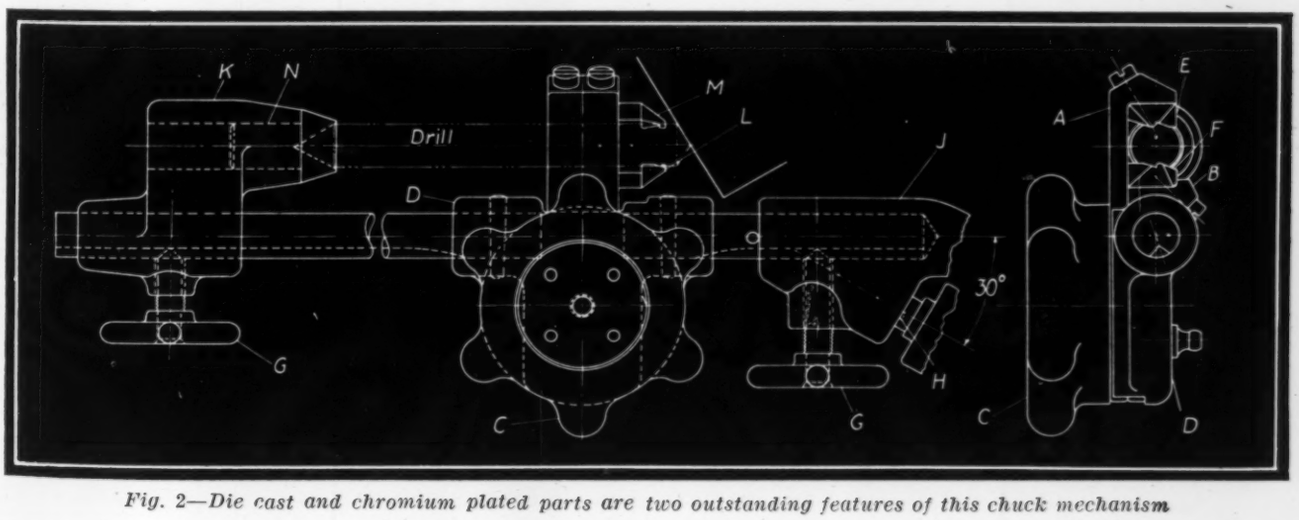


Fig. 2—Die cast and chromium plated parts are two outstanding features of this chuck mechanism

a market for such a machine would not exist. The value of the drill obviously could not exceed the cost of the time and effort involved in reconditioning it for use.

The drill must necessarily be held rigidly at points *L, M,* and *N, Fig.* 2. To effect this, hardened steel jaws *E* and *F* grip on the edges of the flutes as close as possible to the cutting lips. An adjustable back center supports the shank of the drill. A quarter turn of the clamping knob *C,* actuating upper Jaw *A* by means of a cam movement, holds the drill securely without further hand pressure.

In experimental models of the machine, clamping handles *G* were in the form of knurled-head screws but it was found that these made the operator's fingers tender after a time. Use of a die cast star wheel remedied this.

It will be seen that through an idea which made use of available engineering materials and parts, coupled with an investigation into industrial needs, a machine was produced that found a waiting market. Often a process that is carried on by antiquated means goes unnoticed. Reward is in store for those who can apply or extend new ideas to old methods.

Trevithick Attains Long Deserved Recognition

GRATIFYING is the manner in which the world now is recognizing its engineers who laid the foundation for present technological progress. The most significant evidence of this trend is found in a biography recently published which reveals that Richard Trevithick, the Cornish engineer, has at last attained his merited place in the sun. Now considered one of the greatest inventors that ever lived, his life was much in contrast to the fame which his name enjoys. He died in poverty and workmen of a factory buried him in an unmarked grave at Dartford, Kent, to save his body from the potter's field. Recognition as a great inventor did not come to him until fifty years after his death when a window was dedicated to him in Westminster Abbey.

Pioneered High Pressure Steam

Trevithick's life is an inspiration. Machinery fascinated him and he constantly studied ways and means of improving it. He is best known for his work in applying high pressure steam to stationary and locomotive engines. Thereby he brought industry one of its most important assets. But this great benefactor in research and scientific achievement was confronted by many obstacles and opposition as the following statement made not long before his death reveals:

"Nearly thirty years I have been contented with steady, hard labor and immense expense, entirely alone, for the great and incalculable benefit of my country, without receiving any reward; but I have been branded with folly and madness for attempting what the world calls impossibilities, even from the great engineer, the late Mr. James Watt, who said to an eminent scientific character still living that I deserved hanging for bringing into use the high pressure engine."

In spite of his discouraging experiences he forged ahead. Probably his indomitable courage was due to his splendid physique. His biographers, H. W. Dickinson and Arthur Titley remark that he could write his name on a beam six feet from the floor with half a hunredweight hanging on his thumb. He could lift a smith's mandrel which weighed a thousand pounds. Forty years after his death he still was talked of throughout the county of Cornwall as its strongest man.

For eleven years Trevithick was engaged in gold mining in South America. He brought engines with him from England for dewatering mines and seemed to be highly regarded as a mining authority. But a revolution broke out and all possibilities for the fortune he hoped to acquire vanished. Arriving at Cartagena he met Robert Stephenson, a son of George Stephenson, inventor and founder of railways, who gave him money to return to England. Had Trevithick remained in England he might have been the pioneer in railway transportation.

At this stage of his life he took up inventing where he left off, but development had progressed rapidly during his self-imposed exile However, he patented a gun carriage, boilers, superheaters, dredging machines, etc. His career is best expressed in the words of his biographers: He was pre-eminent as a mechanical designer and in his ideas there was no finality; they were limited only by the materials and the state of the machinistic arts of his time.

The book, "Trevithick, The Engineer and the Man," is published by the Macmillan Co. at $5.00, and is available through MACHINE DESIGN at this figure plus 15 cents postage.

New Machines Indicate Design Trends

THERE are, undoubtedly, many machines being manufactured today that are essentially the same as they were five or even ten years ago. However, improvements are the very life of machine manufacturing, as proved by the number of changes that are occurring constantly in machines of leading makes.

Evidence of continued improvement in design is given by the accompanying list of machines recently announced, and the new machines presented pictorially on the following two pages. These units are the reflection of design activity that takes advantage of every improvement in mechanisms, materials or parts to produce a better machine. The ideas embodied in new designs have applications far removed from the field for which the machine itself is intended.

One of the major trends emphasized by many designs is the incorporation of all accessory parts in a single unit. Users are loathe to accept a machine that has to be bolstered by the purchase of extra parts, to be grouped on and about their purchase in a more or less haphazard manner. An example of going even further in combining parts into a single machine is the kitchen servant discussed on page 19 where the user is provided with a number of different machines in a single frame.

Air Conditioning

Unit Conditioner,
Kauffman Air Conditioning Corp.,
St. Louis.

Portable Conditioner,
William C. Carr Corp.,
Boston.

Heater and Conditioner,
Delco Appliance Corp.,
Rochester, N. Y.

Brewing

Small Capacity Malt Crusher,
Sprout, Waldron & Co.,
Muncy, Pa.

Water Filter and Grease Extractor,
Blackburn-Smith Mfg. Co.,
Hoboken, N. J.

Chemical

Continuous Centrifuge,
Bird Machine Co.,
South Walpole, Mass.

Construction

Utility Air Hoist,
Ingersoll-Rand Co.,
Phillipsburg, N. J.

Screening Machine,
Orville Simpson Co.,
Cincinnati, O.

Dairy

Compact Cooler,
Mojonnier Bros Co.,
Chicago.

Milk Bottle Filler and Capper,
Cherry-Burrell Corp.,
Chicago.

Domestic

Food Mixer,
General Electric Co.,
Bridgeport, Conn.

Clothes Washer,
Nineteen Hundred Corp.,
Syracuse, N. Y.

Electric Refrigerator,
Fairbanks-Morse Home Appliances Inc.,
Chicago.

Chest Type Refrigerator,
Crosley Radio Corp.,
Cincinnati, O.

Clothes Washer,
Automatic Washer Co.,
Newton, Ia.

Food

Cocoa Press,
Fred S. Carver,
New York.

Food Products Filler and Capper,
Horix Mfg. Co.,
Pittsburgh.

Salt Press,
Hydraulic Press Mfg. Co.,
Mount Gilead, O.

Metalworking

Automatic Milling Machine,
Kearney & Trecker Corp.,
Milwaukee.

Pipe Threading and Cutting Off Machine,
Landis Machine Co.,
Waynesboro, Pa.

Speed Lathe,
Schauer Machine Co.,
Cincinnati, O.

Horizontal Boring, Drilling and Milling Machine,
William Sellers & Co. Inc.,
Philadelphia.

Semiautomatic Crankshaft Lathe,
Wickes Brothers,
Saginaw, Mich.

Nut Tapping Machine,
National Machinery Co.,
Tiffin, O.

Mining

Coal Spraying Machine,
Viking Mfg. Co.,
Jackson, Mich.

Mobile Loader,
Myers-Whaley Co.,
Knoxville, Tenn.

Power Plant

Underfeed Stoker,
James Beggs & Co. Inc.,
New York.

Hypressure Jenny,
Homestead Valve Mfg. Co.,
Coraopolis, Pa.

Production

Parts Counter,
Durant Mfg Co.,
Milwaukee.

Pumping

Air Displacement Pump,
Air-O-Matic Products Co.,
Wichita, Kans.

Refrigerating

Ice Maker,
Waukesha Motor Co.,
Waukesha, Wis.

Ammonia Compressor,
Carbondale Machine Co.,
Carbondale, Pa.

Road Building

Vibrating Screed Board,
Munsell Concrete Vibrators,
Jersey City, N. J.

Surface Tester,
H. & H. Mfg. Co.,
Elyria, O.

Rubber

Laboratory Banbury Mixer,
Farrel-Birmingham Co. Inc.,
Ansonia, Conn.

Bench Type Tire Groover,
George Associates Inc.,
Worcester, Mass.

Textile

Single-Head Full Fashioned Hosiery Machine,
Wildman Mfg. Co.,
Norristown, Pa.

Yarn Evenness Tester,
Waypoyset Mfg. Co.,
Pawtucket, R. I.

Ball Winder,
Fletcher Works,
Philadelphia.

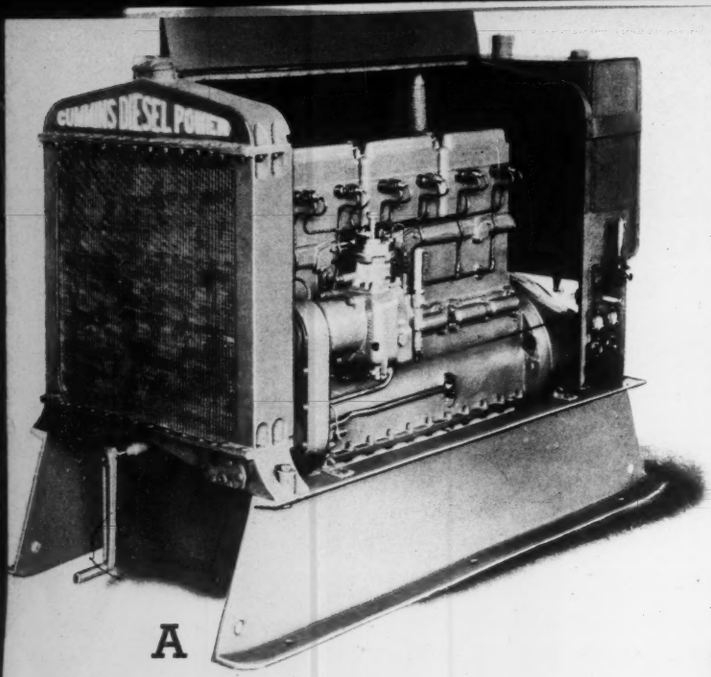
Welding

General Arc Welder,
Universal Power Corp.,
Cleveland.

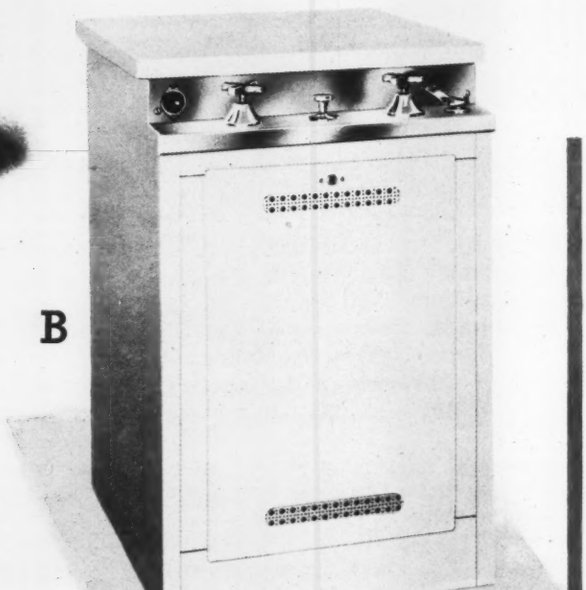
Seam Welder,
Thompson-Gibb Electric Welding Co.,
Lynn, Mass.

Design Fe
in New Mo

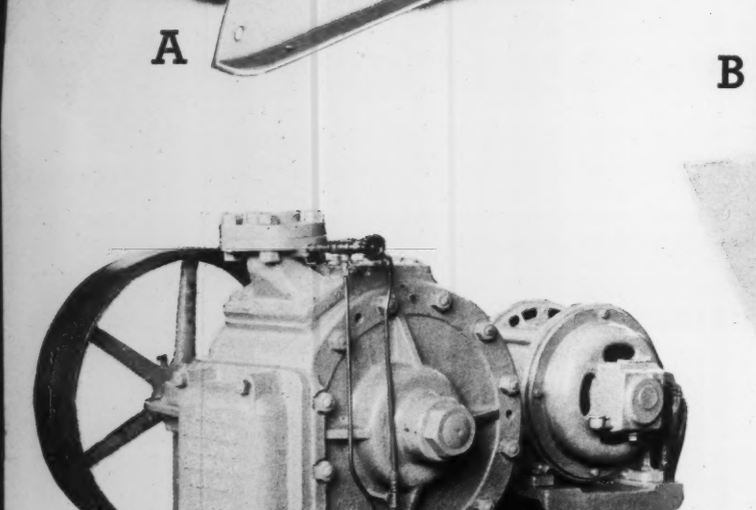
A Pictorial Presentation of
from the Standpoin



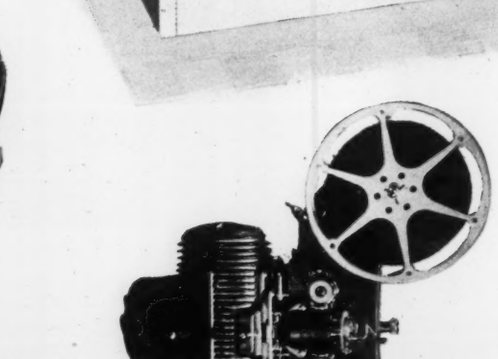
A



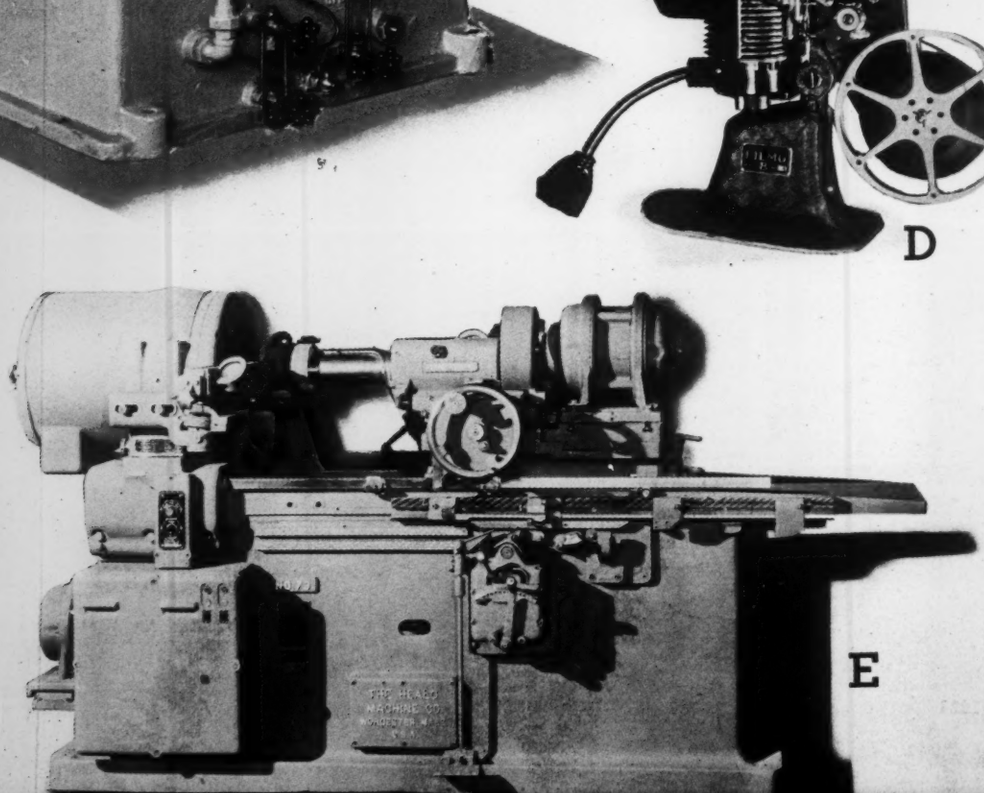
B



C



D



E

(A) The trend toward inclusio
the original design is exemp
power unit built by Cummins
equipped with a large clutch pow
extension on which to mount a p
machinery.

(B) Special materials employed
corrosion on this dishwas
impeller, used to create the wa
of aluminum alloy, and inner
steel. The machine is made by M

(C) Eccentric shaped parts, c
details are eliminated in
Goslin-Birmingham Mfg. Co. Inc.
pump. This construction permit
vibration, as the internal parts a
only.

(D) The new motion picture pr
Co. is entirely gear drive
mechanism employed. This is a
for rewinding the film at the faste
safety. Accurate die castings are
construction.

(E) Vibration is minimized on
grinding machine of Heald
ing the workhead drive motor o
that is carried on vibration dam
the rear of the base. A 10-horsep
on the cross slide base separate fr
preventing the transmission of
spindle.

(F) The single central actuat
new comber of Saco-Lowell
double-sided machine rather th
Fastened to the nipper actuating
there is a square-shanked stud.
through a cross-head mechanis
thence to the central nipper sw

(G) All spindles of bench typ
mounted on ball bearing
equipped with overflow so that
remain at the spindle. This s
Lester & Wasley Co. Inc. for pro
paper, is built almost entirely of
powered machines, thus enablin
changeability.

(H) A parallel motion for supp
features the design of the
machine built by John Royle & S
mechanism, consisting of arms
in a parallelogram arrangement,
tors way as he follows the table
work. As the mechanism move
proportions of the parallelogram
the upper corner at a constant

(J) Lubrication on this deep
Private Utilities Co. is pu
positive pump that is directly dr
and cam from the pinion sha
gears are used throughout, whil
bushed in place. The pump is
are no overhanging bearings.

(K) Streamlining and consid
the marine field is exem
commuter of Consolidated Sh
modified streamlined effect incr
tion while all steering and en
centralized on the flying bridge.

n Features
v Machines

entation of Recent Machinery
Stand point of Design.

toward inclusion of all accessories in design is exemplified in the new diesel by Cummins Engine Co. which is rge clutch power take-off with shaft to mount a pulley for driving other

erials employed to combat rust and this dishwasher include a bronze create the water action, splash ring y, and inner tub of rust-resisting e is made by Modern Maid Co.

haped parts, cams and reciprocating eliminated in the vacuum pump of n Mfg. Co. Inc. which is a truly rotary uction permits of high speed without ternal parts are centered and revolve

tion picture projector of Bell & Howell ely gear driven, with a gear shift ed. This is a regular reversing gear m at the fastest speed consistent with e castings are used throughout in the

minimized on this airplane cylinder hine of Heald Machine Co. by mount- rive motor on a suitable base plate ibration dampeners fastened low on A 10-horsepower motor is mounted se separate from the cross slide thus smission of vibration to the wheel

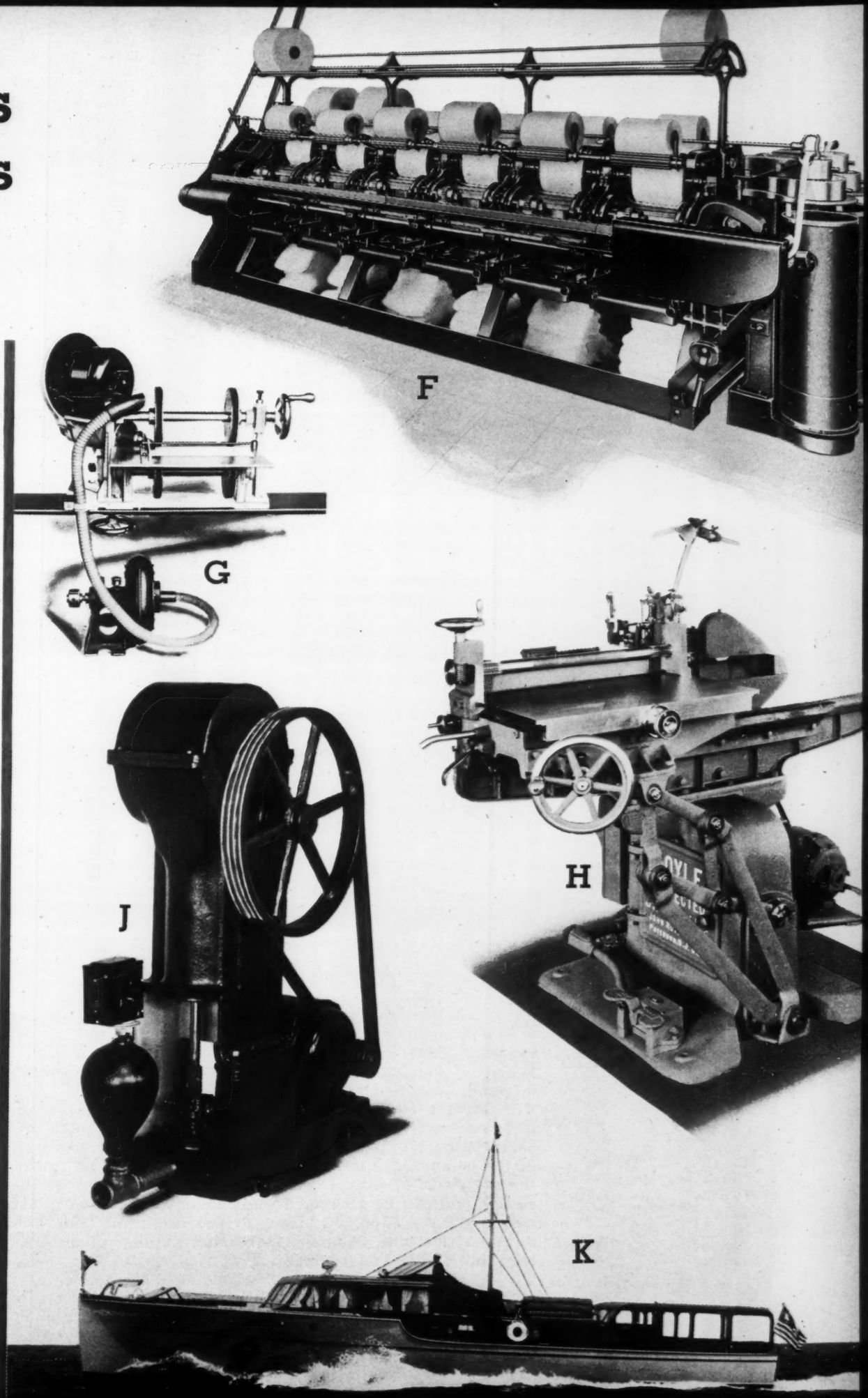
ntral actuating mechanism in the Saco-Lowell Shops makes it a unique ne rather than a "twin" machine. er actuating shaft is a disk in which anked stud. Motion is transferred d mechanism to a long arm and l nipper swing shaft.

f bench type deckling machine are ball bearings, the oil space being low so that too much oil cannot le. This small machine, made by Inc. for producing a deckle edge on t entirely of parts used on the full- hus enabling manufacturing inter-

ion for supporting the traveling bed sign of the photo-engravers beveling n Royle & Sons Inc. The supporting g of arms and ball bearing joints rangement, moves out of the opera- s the table in order to inspect his nism moves through its sector the arallelogram change so as to carry constant level.

this deep well pump of Kewanee Co. is provided by an all-bronze directly driven by a connecting rod inion shaft. Chrome nickel iron hout, while all bearings are bronze pump is close coupled, and there arings.

nd consideration of the operator in ld is exemplified by this cruiser- idated Shipbuilding Corp. The effect increases efficiency of opera- g and engine controls are neatly ng bridge.



MACHINE DESIGN

Materials Consciousness Is Increasing in Minds of Designers

THOUGH a far-removed subject from design of machines, proximity of the yacht races for the America's cup serves to focus attention on metallurgical advances. Practically nonexistent in the competing craft are the old-time wooden hulls and masts. Of the three ships YANKEE, RAINBOW and ENDEAVOUR, only the first mentioned has a mast of wood. The ENDEAVOUR'S mast is welded steel, and virtually the only nonmetallic part of this ship is the flexible "plank" boom of silver spruce. In the RAINBOW, steel and bronze are used for the hull, solid one-inch steel rods for the sidestays and riveted aluminum for the mast.

With these and similar applications of metal in fields that have been devoted almost entirely to wood it is small wonder that designers should become more and more "materials-conscious." Higher speeds and stresses in machinery are a contributing factor. Materials producers are being pressed to meet requirements; conversely they are keeping engineering designers on their toes by success in producing improved alloys and nonmetallic materials.

First-hand information on most of the new developments in materials will be available at the National Metal congress. Such meetings as this and the subsequent Power and Transmission Exhibition in New York advance design progress and cannot be overlooked.

• • •

Air Conditioning to the Fore!

ALL indications point to the increasing use of air conditioning equipment. This type of apparatus may well prove to be to industry what the automobile and the radio have been in former years. Never has a tonic, brought about by rapid development and demand, been needed more than now.

Several leading manufacturers, including Chrysler and Crosley, have entered the air conditioning field. If the rules of industrial competition hold true, these additions should strengthen the status of the companies already interested in this line, and also stimulate the activities of others considering it. Indications of the vastness of the field can be gleaned from the contract placed in this country recently for a $500,000 plant for the Robinson Deep gold mine in South Africa, and from the increasing number of orders for industrial and domestic equipment.

A relatively small number of our 6000 or so machinery building plants have the facilities to avail themselves of this market. Nevertheless, new developments in air conditioning should be followed closely by engineers and manufacturers, both on account of the opportunities presented and engineering achievements involved.

PROFESSIONAL VIEWPOINTS

Machine Design Welcomes Letters Suitable for Publication

Hydraulic Clutch Has Limitations

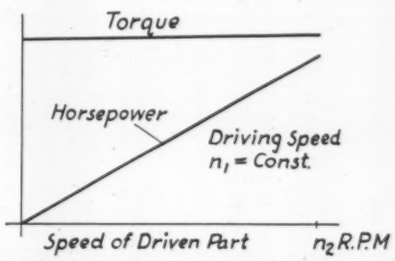
To the Editor:

IN THE April issue of MACHINE DESIGN, you give a description of a Radcliff-type hydraulic clutch which consists of a primary part, a centrifugal pump, and a secondary part, a hydraulic turbine. Both parts are of identical design, no inlet or exit vanes exist, and the medium of power transmission is oil. The advantages of the clutch are that it has a cushioning effect, that any increase of load is automatically taken care of by increase of slippage, and that it can serve as a safety member to prevent excessive loads. It is said that the clutch can operate at different speeds and therefore can serve as a variable speed transmission in an automobile.

Your description of the clutch is not detailed enough to impress the claims clearly enough upon the reader, particularly that it may serve as a variable speed gear. As far as can be seen from the illustration, the pump part and the hydraulic turbine part are identical, and therefore the speed of the driven part must be the same as that of the driving part, minus slippage. If there were inlet and exit vanes the speed of the two parts might differ, and if those guiding vanes were adjustable the speed of the driven part would be variable. Since none of these features are included in the design, the Radcliff clutch is nothing but a clutch. There is only one speed for a given horsepower at which the clutch has a good efficiency, and the range of speeds, due to the characteristics of the centrifugal pump, is quite limited. Slight variations from the point for which the clutch is designed, will result in a considerable decrease of efficiency. Increased load will be taken care of by increase of slippage, and the energy thus lost will be transformed into heat. The result is that the oil in the clutch will be brought to the boiling point unless some provision is made to cool it.

From the accompanying diagrams it may also be seen that a hydraulic transmission of the centrifugal type does not offer the advantages of the mechanical transmission or those of the hydraulic transmission of the displacement type. In the latter, the capacity of the pump alone, or those of the pump and hydraulic motor, are variable. In this manner a range of speeds from zero up to the driving speed is attainable. Theoretically the hydraulic variable speed gear of the displacement type, as well as the mechanical transmission, fulfill all the requirements of the automobile. The hydraulic transmission, however, has never been applied to the motor car, except experimentally, while in stationary machinery its application has been very successful. For automobiles its use is handicapped by the complicated design, excessive price, large size and frequent necessity of repairs.

From a theoretical standpoint, however, these transmissions, of which a large number of designs are on the market, are ideal. In the automobile, the required torque is high at low speed, i.e. when starting or when going uphill. This requirement is now being met by the mechanical



Regulating capacity of pump. Transmission of displacement type

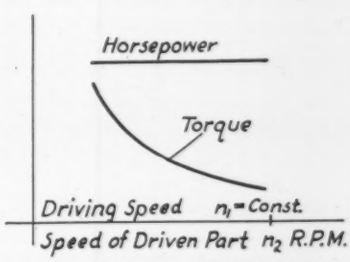
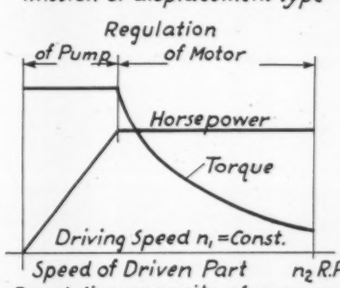
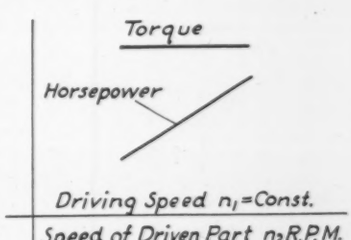


Diagram of mechnical gear transmission



Regulating capacity of pump and hydraulic motor. Transmission of displacement type



Hydraulic transmission on centrifugal principle

It is indicated that a hydraulic transmission of centrifugal type does not offer advantages of mechanical transmission or hydraulic transmission of displacement type

gear transmission which requires operation of three levers for the transmission, the clutch and the gas. The hydraulic transmission can replace the mechanical transmission and the clutch. For the full range of speeds in both directions, only the operation of one lever would be required. The speed of the gasoline motor could remain the same all the time, which naturally would mean a saving of gas and of wear on the motor. As already mentioned, no design has been developed to meet the requirements of the automobile mechanically.

The Radcliff clutch does not replace the variable speed gear, but only the clutch. It has the advantage of being elastic, of not taking excessive loads, and of being more durable than the mechanical clutch. While in the motor car its usefulness seems doubtful, in stationary machinery where a safety element is required, the speed ratio is not variable, and the connection has to be elastic, it may be ideal.

—H. W. HAMM,
Cincinnati, O.

Editor's Note: Hydraulic transmissions are not being applied as standard on any American automobile. They are, however, being used by the Daimler Co. in England and it is understood that many leading automobile makers here are considering this type of transmission.

Guiding Blades Automatically

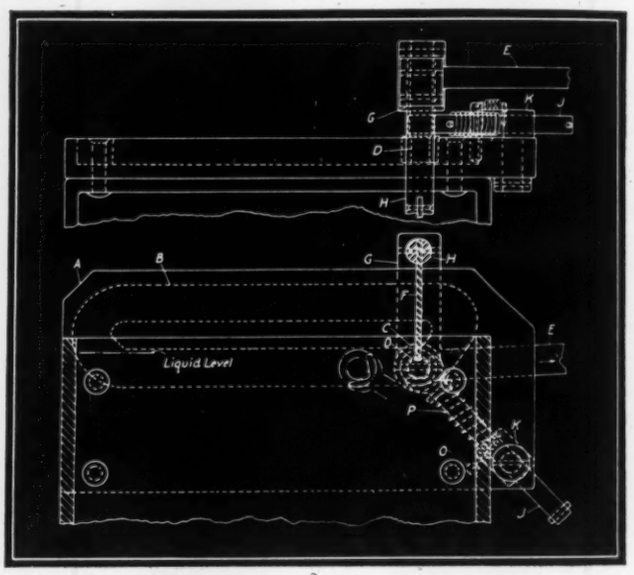
To the Editor:

THE molten lead in the pots of galvanizing machines must be continually skimmed. On one of these machines, the ingenious mechanism shown, which may suggest applications to other designers, is employed for automatically guiding the skimmer blade across the pot. This blade, partially immersed in the liquid, is moved across the pot to skim the slag. It is then elevated clear of the liquid and returned to its starting position where the blade is again immersed and moved across the pot. These movements are repeated continuously.

Two side plates *A*, one on each side of the pot, are riveted securely to the latter. In one of these plates is cut the continuous cam groove *B*. Follower roll *C* engages this groove and is free to turn on stud *D* pinned in the boss on reciprocating arm *E*. One of these arms is provided for each side of the pot and their motion is obtained by a crank (not shown).

Skimmer blade *F* is riveted to cross-bar *H* secured in vertical projection *G* on each arm. Spring-actuated forked plunger *J* engages roll stud *D* and serves to transfer the roll from the bottom cam groove to the top groove. The plunger is supported in pivot bearing *K* to allow the forked end to follow the roll in its irregular path. The angular movement of this plunger toward the left is limited by the stationary pin against which it is held normally by spring *M*. When held thus, the forked end is in position for engaging the roll stud as the roll moves along the lower cam groove in the direction of the arrow. This position of the plunger is indicated in dot and dash outline and shows it in engagement with the roll stud.

When the roll is located in the manner described, skimmer *F* is in its lowest position and being slightly immersed in the lead has skimmed the latter part away across the pot. As the arm *J* continues its movement in the direction of the arrow, the roll and skimmer are carried to the end of the horizontal stroke as shown in full lines causing plunger spring *P* to compress. Arm *J* however has not quite completed its stroke and in doing so, the energy stored in spring P causes plunger *J* to push the roll upward so that when the arm reverses its movement, the roll will be guided along the upper groove in the cam.



Mechanism enables continuously repeating movements for skimming molten lead in galvanizing pots

In this way, the skimmer blade is raised from the lead and as the movement of the arm is continued to the end of its stroke toward the left, the blade is carried back to the other end of the pot. At this point, the roll drops down to the lower groove by gravity, immersing the blade once more in the lead. As the arm reverses its movement it causes the roll to move toward the right with the blade, the latter at this time skimming the lead. This completes the cycle of movements which are repeated for each cycle of arm *J*.

One advantage of the gravity drop of the roll at the left hand end of the cam groove is that the resulting shock dislodges any slag that adheres to the blade.

—J. E. FENNO,
Belleville, N. J.

MEN OF MACHINES

FOR forty years Edward A. Johnston has been associated with International Harvester Co. During that time he has been active in development work, particularly tractor design. Now he becomes vice president in charge of engineering.

Mr. Johnston entered the company's employ in Chicago as a machinist and patternmaker in 1894. Two years later he was transferred to the drafting room and in 1907 was given charge of design and manufacture of auto buggies.

After serving as chief engineer and subsequently superintendent of the Akron, O., plant, he returned to Chicago to assume the same positions at the new tractor works. Six years later found him manager of gas power engineering. In 1922 he became engineering director.

EDWARD A. JOHNSTON

• • •

ONE of the newly nominated vice presidents of the American Society of Mechanical Engineers is Harry R. Westcott. He is president of Westcott & Mapes Inc., New Haven, Conn., and has been quite active in A.S.M.E. affairs. In 1931 he was elected manager.

Born at Dighton, Mass., December, 1881, Mr. Westcott obtained his education at Providence technical high school, Rhode Island School of Design, Brown and Yale universities. For several years he was with Atlantic Mills, A. D. Julliard Co., and Hood Rubber Co.

At the time he became a member of the A. S. M. E. in 1915 he was affiliated with United Illuminating Co., New Haven. Shortly thereafter he organized the engineering firm he now heads.

HARRY R. WESTCOTT

• • •

SUCCESS of observations made during stratosphere flights, as in other types of research, depends on the efficiency of scientific apparatus. The responsibility for equipment of this nature falls on such engineers as Henry Kurtz, whose chief work with Bausch & Lomb is designing optical instruments.

When he was thirteen years old Mr. Kurtz started with the company as errand boy. At the age of fourteen, thirty-two years ago, he won a competitive scholarship at Mechanics Institute, Rochester. When the course was completed he returned to Bausch & Lomb where he spent the succeeding eight years in the drafting department.

His firm then financed his way through the University of Rochester and in 1915 he became attached to the scientific bureau

HENRY KURTZ

of the company. Mr. Kurtz is the author of many published articles on the design of optical instruments and holds membership in the Optical Society of America of which he is treasurer and one of the directors.

* * *

HENRY M. CHASE retired recently from the engineering staff of the Worthington Pump & Machinery Corp. He has invented and patented a number of improvements in pumping machinery.

* * *

CARL MOREY, formerly affiliated with Hydraulic Press Mfg. Co. as a consulting engineer, recently joined the E. W. Bliss Co., Salem, O., as an hydraulic engineer.

* * *

J. H. COESFELD, twenty-three years connected with the Baker Ice Machine Co., Omaha, has joined the Rempke Fin Coil Co., Chicago, as chief of its engineering division.

* * *

EDWARD R. MAURER, professor of mechanics at University of Wisconsin, recently was made the recipient of the Lamme medal by the Society for the Promotion of Engineering Education.

* * *

R. H. DANFORTH, for 20 years professor of mechanics and materials at Case School of Applied Science, Cleveland, has been made administration member of the code authority for the drop forgings industry.

* * *

ARTHUR SIMON, prominent Milwaukee electrical engineer, received the honorary degree of doctor of science from Marquette university recently. He holds more than forty patents on important electrical control devices.

* * *

T. SMITH TAYLOR, who for a number of years was in charge of the physical laboratory, Bakelite Corp., and later in consulting work, has been appointed head of the department of physics of Washington and Jefferson college.

* * *

THOMAS W. CARRAWAY, an engineer of broad experience in air conditioning, has resigned from the Grinnell Co., Providence, R. I., to open his own engineering firm in Dallas, Texas.

* * *

WILLIAM A. NEILL, who has been associated with the Dorr Co. in mechanical engineering and production work for the past eighteen years, has resigned to engage in a consulting practice in New York.

* * *

J. E. ARCHER, for the past four years associated with PROF. COLIN G. FINK of Columbia university, has joined the staff of Battelle Memorial institute, Columbus, O. He will devote himself to electro-deposition problems, particularly in bearing alloys.

* * *

HUGH S. JOHNSON, national recovery administrator, has approved the method of selection and recognized the following members of the code authority for the gear manufacturing industry: H. H. KERR, North Quincy, Mass.; R. C. BALL, Philadelphia; RICHARD FERGUSON, Gastonia, N. C.; HOWARD DINGLE, Cleveland; F. H. FOWLER, Chicago; FRANK B. DRAKE, Berkeley, Calif.; and to represent nonmembers of the American Gear Manufacturers association: CUTTER P. DAVIS, Springfield, N. Y., with RODNEY DAVIS, Philadelphia, as alternate.

* * *

V. A. OLSEN has been appointed works manager of Cadillac Motor Car Co., Detroit.

* * *

F. M. FARMER, vice president, Electrical Testing Laboratory, has been elected a director of the American Institute of Electrical Engineers.

* * *

REAR ADMIRAL TAKETARO MATSUDA of the Imperial Japanese navy, has been made general secretary of the Nihon Kogakkai or Engineering Society of Japan.

* * *

JOHN ARMS, New York industrial engineer, has been elected secretary of United Engineering Trustees Inc., succeeding Alfred D. Flynn, resigned.

* * *

PROF. C. C. WILLIAMS, Iowa State university, recently was elected president of the Society for the Promotion of Engineering Education.

* * *

R. R. WEDDELL, formerly chief engineer of O. K. Tool Co., Shelton, Conn., recently returned from abroad where he acted as consulting engineer to Richard Lloyd & Co. Ltd., Birmingham, Eng.

* * *

P. G. AGNEW, secretary, American Standards association, has been appointed a member of the National Research council of the National Academy of Sciences. PRESIDENT ROOSEVELT has requested the academy to perpetuate the research council.

* * *

J. A. EHLINGER has been appointed chief engineer of R-S Products Corp., Philadelphia, which recently took over Ryan, Scully & Co. He was for a number of years assistant to the late G. F. BEACH who headed the engineering department.

Obituaries

DR. EDWARD R. BERRY, inventor of the quartz lens and a widely known scientist, died recently. It was on April 28, 1924, that Dr. Berry announced that in the Thomson laboratory he had perfected a practical method of producing fused quartz which was more transparent than glass. His development was hailed as one of the most important scientific discoveries of the first quarter of the twentieth century. To a considerable extent fused quartz produced by his process has replaced glass in scientific instruments.

* * *

ERNEST J. W. MULLER, chief engineer of the Adams Grease Gun Corp., New York, died last month.

TOPICS

IMPORTANCE of standardization is being multiplied as industry and invention continue to extend their frontiers further into new fields, says Howard Coonley, president of the American Standards association. This statement was made simultaneously with the announcement that nine of the nation's industrial leaders have been named to membership on the ASA advisory committee.

Continuing, Mr. Coonley said that as industry becomes increasingly complex and ramified we must depend more and more upon the coordinating functions of standards. The standardization movement is today one of the most important integrating agencies in the country. It offers a democratic, widely representative forum to which come manufacturers, consumers and distributors to work out together their problems without governmental supervision.

* * *

A five-section subway-elevated car of stainless steel recently was delivered to the New York Rapid Transit Corp. by the Budd Co. of Philadelphia. Advanced engineering ideas are embodied in the new vehicle. An electric controller is stationed at each operating position. This mechanism applies and regulates the eddy current brake as well as the air brake. Normal braking service down to approximately five miles per hour is accomplished by the eddy current brakes, braking effort of which is dependent upon the speed of the train and upon its field current, which of course is under the control of the motorman.

* * *

Bearing out the contentions made editorially in August MACHINE DESIGN, Waldemar Kaempffert in the *New York Times*, Aug. 26, calls attention to a plan of Prof. Arthur H. Compton, Nobel Prize winner, to let mechanism take all the risks in stratosphere flights. Very wisely and very scientifically, Mr. Kaempffert says, Prof. Compton proposes to sit in security and at ease in his laboratory while his robot informs him by radio just what its findings are.

A year has been spent by Professors Compton and J. M. Benade in perfecting a device about to be tried. Entire cost of materials of the balloon and instruments is little more than $100. A gas bag which, when fully inflated, has a diameter of 15 feet sustains a gondola weighing only ten pounds. The principal instrument to be sent aloft is an electrical measuring device—an electrometer.

* * *

The bathysphere, with which Dr. William Beebe, famous deep-sea explorer, has broken all previous diving records, is an engineering achievement. The sealed globe is a large metal ball with steel walls 1½ inches thick and windows of fused quartz 3 inches through. It is subjected to a pressure of 980 pounds to the square inch. The major problem in constructing the metal chamber was the windows. Ordinary glass of sufficient thickness to withstand the high pressures would be far from sufficiently transparent. This aspect of the proposition was solved by GE engineers who produced three "blanks" of fused quartz eight inches in diameter and three inches thick. The quartz possesses a much higher transparency than glass and has a compressive strength about six times that of glass. The bathysphere was invented by Dr. Otis Barton.

* * *

In connection with the discussion on page 40 of the August issue of MACHINE DESIGN, it is interesting to note that the A.S.M.E.—A.S.T.M. joint research committee on effect of temperature on the properties of metals recently voted to draw up a definite plan (for submission to letter ballot) for experimental study of methods of evaluating the load-carrying ability of metals under prolonged stress at high temperatures. The "creep" of selected materials will be studied by test runs to be carried out, not

merely for 1000 to 2000 hours, but for three years or say 25,000 hours, in order that the validity of various methods of approximation and extrapolation and the relation of various "short cut" methods to actual long-time performance may be evaluated.

* * *

Because color is playing an important role in the machinery field these days, it is interesting to note that green was the one automobile color to record a noteworthy advance in public favor during July. This color occupies third place in automotive color preference for the first time in 18 months. Leadership still is retained by black with blue in second place.

* * *

There is encouragement in the recent report of Collins P. Bliss, dean of New York university college of engineering. He declares that a demand for more engineers in the next four or five years will prevail as a result of the development of new industries and inventions which have been retarded by the depression, and the new governmental attitude toward public works. It is unfortunate, he asserted, that the entrance of our young people upon professional careers is influenced too often by immediate rather than prospective opportunities in the several professions. Conditions change radically sometimes in four or five years. Right now, for example, there is a sufficiency of engineers, but one of our great industrial organizations predicts after careful study, the entire absorption of this group by the end of 1936, with a probable shortage of available engineers at that time.

* * *

In the radio field the ingenuity of designers is particularly apparent. New dials for instance are being built to simplify tuning. One unique arrangement recently introduced by a leading manufacturer tunes in the desired wave band and then illuminates only that portion of the dial. Another radio maker has colored the various portions of the dial to make it easier to locate various foreign cities, police calls, airplanes, etc. Listeners are in the police range when in the green area. Red indicates the foreign wave band; blue, the aircraft waves, and black denotes where the amateurs lurk. A sound beam diffuser is another innovation designed to direct the sound to all parts of the room with equal intensity. These and other developments equally as interesting are the engineer's contributions to radio science that points to a new era in radio design.

* * *

One of the more significant news bulletins to come out of Moscow, Russia is to the effect that a monopoly held by Germans for the past seven years has been broken by an American typewriter firm. The dispatch declares that the company has reached an agreement in principle with the Soviet Commissariat for Heavy Industry to supply technical assistance to set up in Moscow a large factory for manufacturing typewriters on a mass production basis. Formerly all Soviet-made machines have been German models. In return the Soviet agrees to buy 10,000 typewriters on relatively short term credit.

* * *

By an ingenious application of stroboscopic principles engineers of one of the leading automobile manufacturers have provided hairbreadth accuracy in motor ignition timing. A small neon lamp that flashes each time the spark plug of No. 1 cylinder fires, illuminating a polished steel ball set in the rim of the flywheel, facilitates the timing. Flashing of the lamp is so quick that the ball appears to be standing still. By rotating the distributor until the ball appears directly in line with a pointer, the timing can be set to an accuracy of one-half of one degree.

* * *

Observations made by Reginald M. Cleveland, aeronautical editor of the *New York Times,* indicate that science in many fields is the handmaiden of aeronautical progress. He brings attention to two recent developments in the interest of blind flying. Tests at Round research station of Col. E. H. R. Green at South Dartmouth, Mass., give promise of success in dissipating fog by chemical condensation. This obviously would be a boon to flying.

Simultaneously the Bureau of Air Commerce has announced that D. M. Stuart, one of its engineers, has developed a method of identifying the cone of silence—the dead space immediately above the transmitting towers of a radio range beacon. This has been done by building a high frequency transmitter which projects a vertical beam in the cone of silence area. To receive this signal, by which a flyer near a fogged-in airport can orient himself, a small light receiver in the plane is tuned constantly to one frequency. Upon reception of the signal a red light is lighted on the instrument board.

* * *

Engineers will be interested to know that printed copies of the revised simplified practice recommendation on taper roller bearings now are available from the Superintendent of Documents, Washington, for five cents each. The current revision of this project brings the pro-

(Concluded on Page 46)

NOTEWORTHY PATENTS

USE of a belt driven expansible pulley located on the shaft of the combined yarn traversing and package driving roll constitutes a noteworthy feature of a winding machine designed by J. O. McKean. The patent recently granted the unit is assigned to Foster Machine Co. The mechanism employed provides increased tension on the belt at intervals to expand the

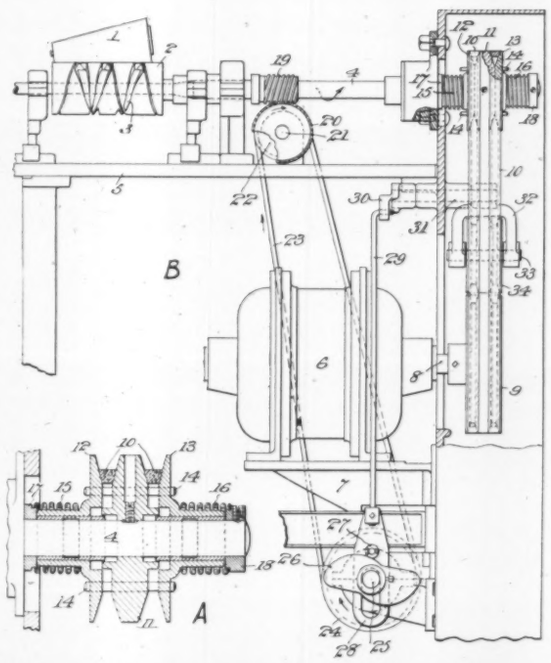


Fig. 1—Intermittent pressure on belt controls the speed through expansible pulley on winding machine

driven pulley and thereby increase its speed by decreasing its effective diameter. Object of the invention is to prevent the tendency in winding yarn to lay one turn on another which causes undesirable protuberances to be produced in the wound package.

Comprising the double expansible pulley shown at *A*, *Fig.* 1, is an intermediate member 11 held by a set screw to roll shaft 4, and two movable members 12 and 13 slidably mounted on the shaft. These two latter parts are interlocked with member 11 by pins 14. Coil springs 15 and 16 interposed between their respective movable members 12 and 13 and collars 17 and 18 fast on roll shaft 4, serve to urge the movable members toward part 11.

Camshaft 25, *B*, *Fig.* 1, is provided with cam 26 which engages roller 27 carried by follower 28. Rock shaft 31 carries a yoke 32 provided with a cross shaft 33 on which mounted a double pulley 34 arranged, when swung outwardly, to act on belts 10 for increasing tension thereon at intervals. Thus the pulley is expanded on roll shaft 4 to bring belts 10 closer to the axis of the shaft and thereby speed up the shaft and its combined yarn traversing and package driving roll 2. Package 1 which is being wound, is driven by frictional surface contact with roll 2.

Follower actuating cam 26 has gradual and abrupt faces which successively engage follower roller 27 so that the yarn traversing and package driving roll 2 is speeded up more rapidly than it is slowed down. Because of the changes of rotative speed of the yarn traversing and package driving roll, package 1 having a certain amount of momentum of its own, will slip upon roll 2 as the roll speeds up rapidly, thus breaking up the winding of one strand of yarn directly upon another strand or what commonly is known as ribbon wind.

The patent is identified as No. 1,966,259.

INERTIA forces and particularly centrifugal forces are utilized to transmit power from a driving to a driven member in a torque converter designed by John C. Slonneger. Falk Corp., Milwaukee, is assignee of the recently issued patent. The mechanism, *Fig.* 2, comprises several pairs of pinions 14 and 15, each freely rotatable on individual stub shafts 16 which are anchored securely in web 11 of the flywheel. Each of the pinions 14 meshes with gear 17 having a hub 18 splined on the end of a driven shaft 19. Arrangement is such that when drive shaft

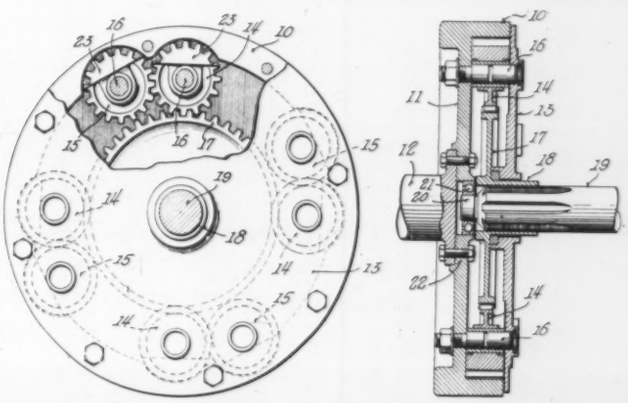


Fig. 2—Centrifugal force is employed to effect transmission of power from driving to driven member

12 is rotated with respect to driven shaft 19 pinions 14 revolve with the flywheel, these pinions also being mechanically free to rotate in the same direction about their individual shafts 16 as a result of engagement with gear 17.

Pinions 15 are of the same diameter as pinions 14, and each meshes with one of the pinions 14, so as to rotate at the same speed but in reverse direction. Pinions 14 and 15 are loaded eccentrically by counterweights 23, so arranged that during rotation the eccentric center of gravity of each approaches an outer dead center position. The same phase relation thus is maintained between the unbalanced masses of both pinions of a pair during rotation in opposite directions.

During rotation of drive shaft 12 and consequent revolution of the unbalanced pinion masses therewith, the centrifugal forces acting on those masses tend to retain the centers of gravity in their outermost positions and thus tend to hold the pinions against rotation about their individual axes. This effect is opposed however, by the torque load on the driven shaft 19 which, reacting through gear 17, tends to cause rotation of the pinions.

When the centrifugal forces, thus acting, are sufficient to hold the pinions against individual rotation, in opposition to the torque load on the driven shaft, the driven shaft then rotates at the same speed as the drive shaft. When the centrifugal forces are insufficient to overcome the opposition of the torque load on the driven shaft, the several pinions rotate about their individual axes at a rate corresponding to the rate of relative rotation between the driving and driven shafts.

During rotation of the pinions, additional centrifugal forces are set up as a result of the rotation of each unbalanced pinion mass about its individual shaft 16, and as each of these additional forces continuously changes its direction with respect to the revolving system, including the flywheel, the effect of each is periodically to accelerate and decelerate the system.

For example, let it be assumed that the system is revolving clockwise, *Fig.* 2, that gear 17 is stationary and as a consequence, that pinions 14 are rotating clockwise about their respective centers. Then the centrifugal effect on counterweight 23 of each pinion 14, when passing through a position ninety degrees from that shown, sets up a force tangential to the revolving system tending to accelerate it. Also, the centrifugal effect of that counterweight when passing through a 270-degree position, sets up a force tangential to the system tending to decelerate it. These forces, if unopposed would tend periodically to increase and decrease the rate of revolution of the system including the flywheel, thereby causing the torque applied to gear 17 to fluctuate periodically between positive and negative values.

In the mechanism shown in *Fig.* 2, however, these accelerating and decelerating forces, resulting from the individual rotation of unbalanced pinions 14, are continuously nullified by the equal and opposite tangential forces resulting from the simultaneous reverse rotation of unbalanced pinions 15, so that the torque applied to gear 17 by the revolving system is unaffected by those additional centrifugal forces which may result from individual rotation of the pinions. With this effect thus eliminated, the degree of fluctuation in the torque transmitted to gear 17 is reduced and those negative torques are eliminated substantially or at least so reduced as not to impair the functioning of the device.

This patent is designated No. 1,966,107.

IMPROVEMENTS in shaft mountings are embodied in an invention of a seal for liquid agitating means, which recently was granted a patent. R. F. Goecke is the designer and Pfaudler Co. has been assigned the patent designated 1,965,698. The device on the agitator shaft, *Fig.* 3, for sealing the opening in the tank includes a bushing 34 positioned within the flanged portions 11 and 12 of the tank. When properly adjusted the bushing is clamped in position by a nut 38 threaded on the outer end of the bushing.

Diameter of that portion of the bushing with-

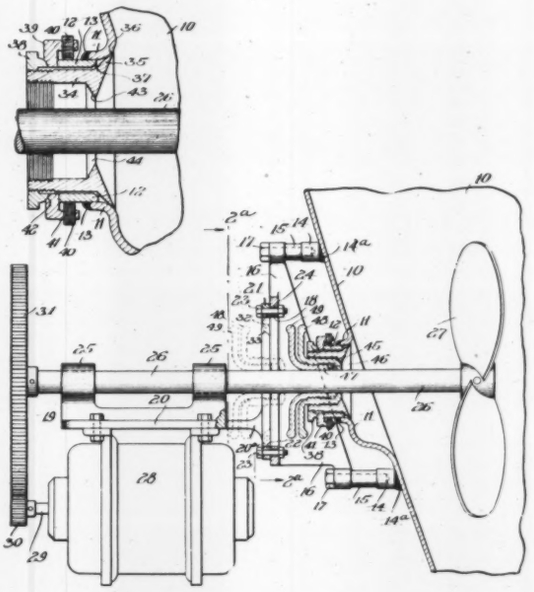
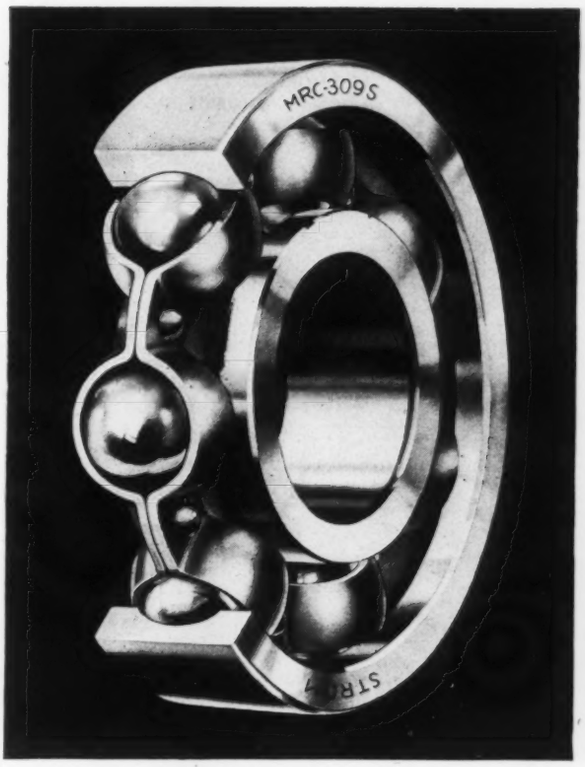


Fig. 3—*Shaft mounting is designed to incorporate seal for liquid agitator in tank*

in flange 12 is somewhat less than the inner diameter of the flange to permit slight rocking or lateral shifting of the bushing to align its axis with that of the shaft when the latter has been fixed by adjusting bracket 19. Ring 45 is provided with one or more layers 46 of any suit-



THE M-R-C line gives the engineer a selection of three types of radial bearings. Illustrated here is the M-R-C Single-Row Super-Conrad - Strom Type S. Deep, uninterrupted race grooves . . . heavy gauge pressed steel retainer . . . greatest radial and two-direction thrust capacity for the Conrad type of Radial bearing — are its most important features.

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23 TYPES *simplify* CORRECT BEARING SELECTION

With twenty-three bearing types before you, it is not difficult to select the design that will give best results in any installation. Here is one reason why engineers and designers keep an M-R-C catalog close at hand. Furthermore, every bearing in the M-R-C line is the most highly developed of its type, tested through years of service, and made by an organization that has concentrated on the manufacture of high quality ball bearings for more than 36 years.

M-R-C Strom SRB Gurney Ball Bearings

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M-R-C BALL BEARINGS

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able packing to seal the opening around the rotating agitator shaft against leakage. Handles 48 and 49 are provided on rings 45 and 47 for unscrewing them to permit movement to the dotted line postion shown, thereby exposing the bushing and other parts for cleaning and and sterilizing.

FOR taking up wear and lost motion C. E. Wyrick has designed for the Wyrick Engineering Co. a simplified compensator, *Fig.* 4. The invention, for which patent 1,966,780 has been granted, consists of a pair of duplicate annular members formed with spirally cammed engaged faces 2. These are jointly embraced or surrounded by a continuous coil spring 3 which tends to separate them, thereby increasing their thickness. Members 1 and 2 form a groove 4 extending around their outer periphery, seating and retaining spring 3. The ends of the spring are secured to members 1 by bending its ends and inserting them in radial sockets 6.

Side walls of groove 4 are inclined from the bottom so that the coil spring will seat upon the outer edges of the walls and thus clear the bottom of the groove. It is obvious therefore, that the contractive tension of the spring tends to spread members 1 apart.

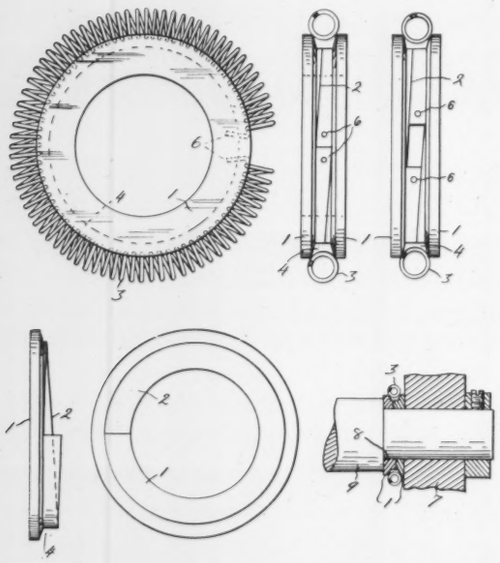


Fig. 4—*Simplified compensator for taking up wear and lost motion utilizes coil spring*

The compensator may be installed on any shaft, rod or other cylindrical member to take up wear or lost motion between spaced parts. As an example, *Fig.* 4 shows the device installed to take up thrust between a bearing 7 and shoulder 8 of shaft 9, journaled in the bearing. As wear occurs between the bearing and the shoulder the compensator is correspondingly increased in thickness due to relative rotative response of members 1 to spring 3, whereby longitudinal play between the shaft and bearing is avoided.

Topics of the Month

(*Concluded from Page* 42)

gram into accord with the SAE revised standard and extends the scope of the original recommendation to include larger bearings and also certain steep angle bearings for naval and general use.

* * *

Magnesium metal, which is approximately one-third lighter than aluminum, is winning wide acceptance for commercial applications in Europe. A fast streamlined train, the Hamburger, is made of this metal. Other important uses include wheels of many London buses and various parts of airplanes.

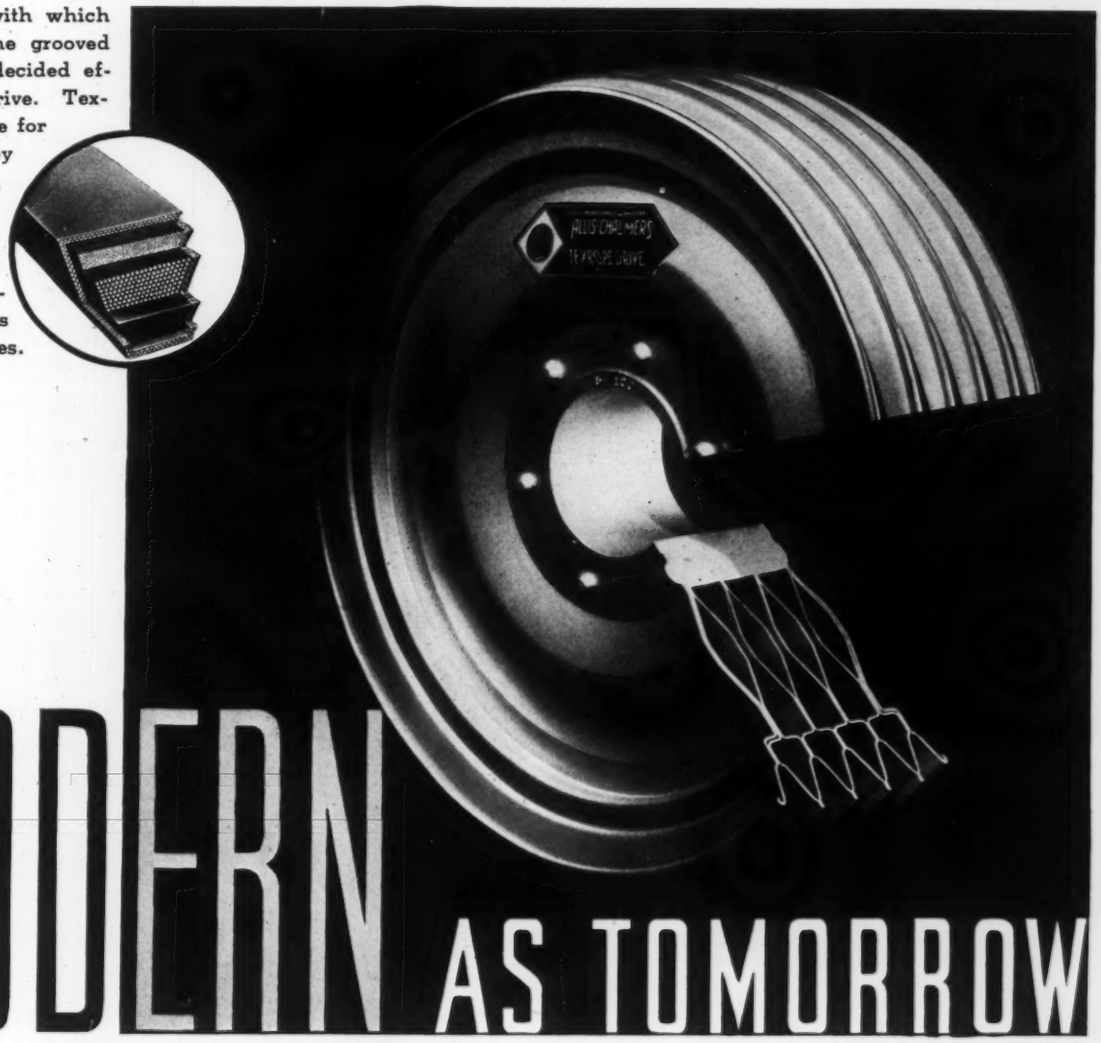
* * *

A recent London dispatch refers to a new machine for the detection of spurious coins, invented by R. J. Lyttle of Sidney, Australia. The unit, which has been installed in Sidney banks, is inclosed in a box about six inches square. A small dial on it is marked 2s, 1s and 6d, along with a zero marking. A suspected coin is dropped into the slot, and a button pressed. If the coin is genuine a pointer on the dial swings around to the appropriate marking; if it is spurious the pointer remains at zero. The machine is said to test the alloy composition of each coin and operates on a new principle, the fundamentals of which were not explained.

* * *

Added to recent applications where high-speed cameras have been employed in research is one in which behavior of fuels inside engines are studied photographically. Motion picture cameras used at Langley Field where the experiments are being carried out, are designed especially for photographing fuel sprays. One of the two machines employed takes twenty-five pictures at rates up to 8000 per second, the duration of each exposure being one-millionth of a second. The film is on a rapidly rotating drum, with the room in total darkness, the lens left open and the spray illuminated by light from 30,000-volt electric sparks discharged at the above-mentioned rate. The other camera has a rotary optical shutter and therefore does not use sparks. It takes pictures at the rate of 2000 per second, duration of each exposure being one six-thousandth of a second. Because it takes several thousand pictures without reloading, and photographs the combustion of the fuel as well as the fuel spray, it has an advantage over the other camera.

The accuracy with which the belts fit the grooved sheave has a decided effect upon the drive. Texrope Belts, made for Allis-Chalmers by B. F. Goodrich, are formed in precisely machined molds. They seat perfectly in the grooves of Texrope Sheaves.



MODERN AS TOMORROW

SO superior are Texrope Multiple V-belt Drives to all others that no new installation of power-driven machinery is up to date without them.

Texrope Drives lengthen the life of any machine, whether old or new. They neither slip nor backlash, thus do away with jerks and jars. Starting is smooth . . . vibration is eliminated . . . the noisy clatter of gears and chains, and the whir of flat belts is conspicuously absent.

Whether working conditions are adverse or ideal—results are the same. Where dirt and dust fill the air . . . where there is moisture or dampness . . . where the strain of heavy loads is greatest—there Texrope Drives are quietly doing their work, in the most efficient way.

Texrope Multiple V-belt Drives hold down operating costs. Replacements are infrequent. Scientific tests prove they are 98.9 percent efficient. No wonder plants of all kinds are installing them everywhere.

ALLIS-CHALMERS MFG. CO. MILWAUKEE, WIS.

TEXROPE DRIVES

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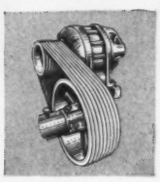
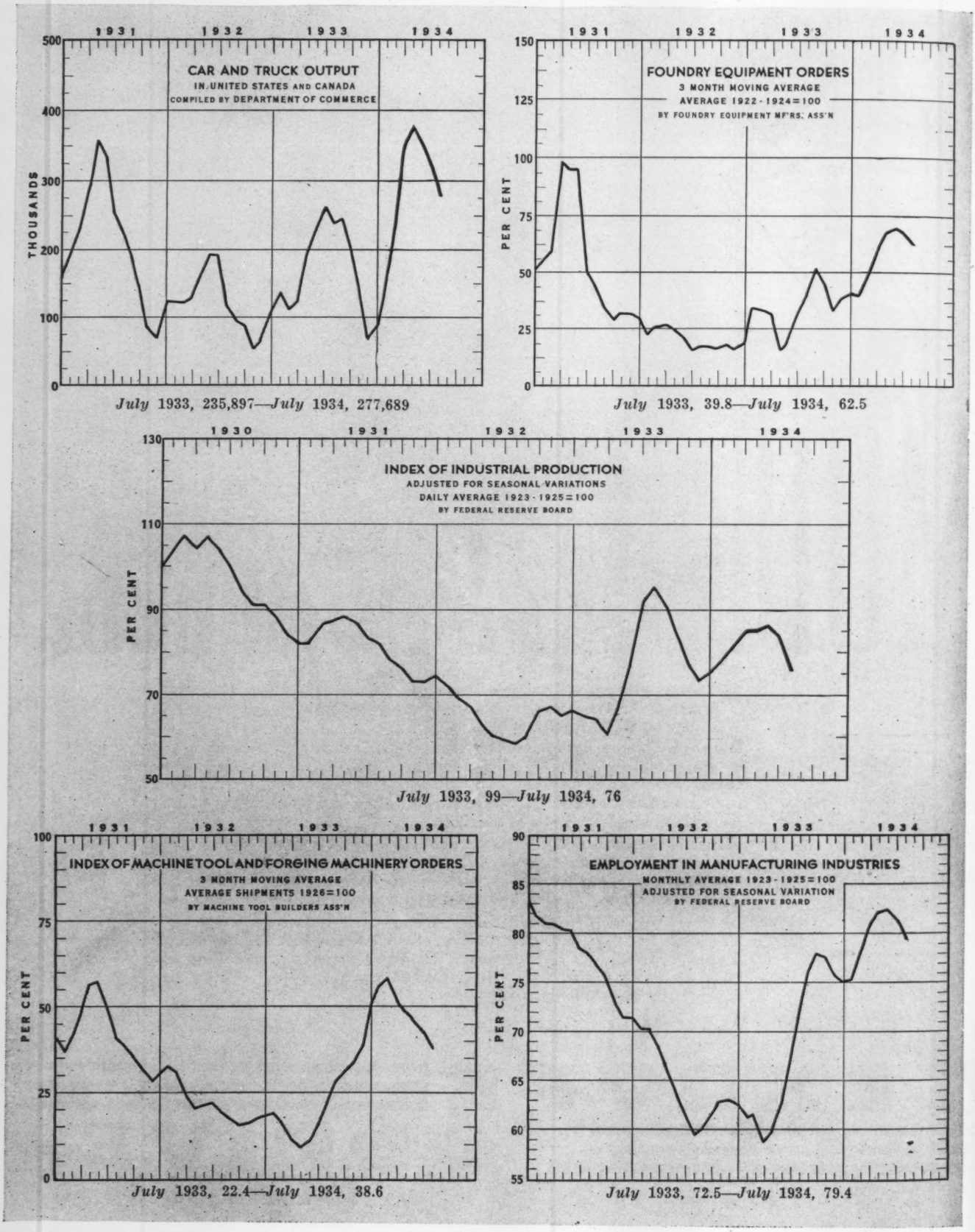


ALLIS-CHALMERS

How Is Business?



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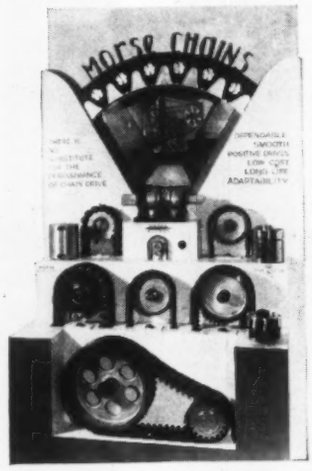
POWER TRANSMISSION NEWS

In all their shining glory you will find Morse silent and roller chains, clutches and Morflex couplings on display and in action at the Century of Progress in Chicago.

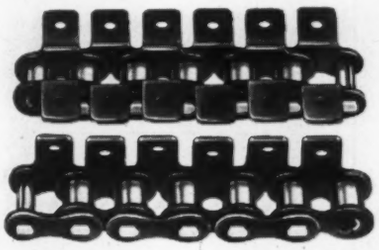
Light and action and working demonstrations all contribute to the interest of this elaborate exhibit, which is part of the complete Borg-Warner display.



We believe that, like thousands of others, you will feel that a visit of inspection to this display will be well worth your while. Be our guest.

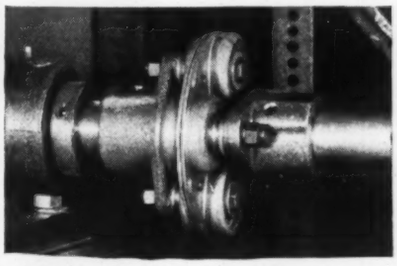
Roller Chains Standard Attachments

For use as conveyors, Morse Roller Chains are equipped with standard attachments which can be fitted to either side of the chain, or both sides.



Morflex Couplings

Shock and vibration, angular and parallel misalignments of shafts are "meat" for



the Morflex coupling, developed by the Morse Chain Co., Ithaca, N. Y.

The secret of its extreme flexibility without power loss is the especially developed, resilient, non-cold-flow, live rubber blocks. They have great resistance to deterioration. Because of the absence of friction and heat generation, tests have shown negligible power loss in this coupling.

The floating center reduces the effect of angular or parallel misalignment and the live rubber cushions uneven impulses, sudden reversal and vibration.

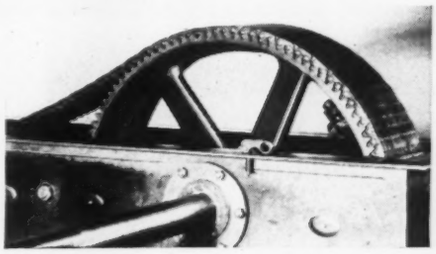
Add to these advantages the facts that no lubrication is ever required, no protection is needed against dirt, grit, water or weather, that there is no wear, no noise, no back lash, low cost, and you have many good reasons for its tremendous success in a multitude of services.

The Morse Morflex coupling, to be absolutely frank with you, simplifies the problem of 100% power transmission where shaft misalignment is encountered. There are many bores immediately available for use.

Morflex couplings with bores from 3/8" to 2 7/8" are carried in stock.

...REWARD!

WE WILL PAY THE PERSON SENDING A PHOTO OF THE OLDEST MORSE CHAIN IN OPERATION $25.00



We are continually hearing about Morse Silent Chains that have been in satisfactory operation for upwards of twenty years.

We want to find the oldest one, and we are willing to pay for it. Perhaps you have a Morse Chain in your plant that would qualify. Send along a picture of the installation. If it's the oldest we receive, you will get a check for $25.00. Write a short statement about the work it performs.

MORSE CHAIN COMPANY

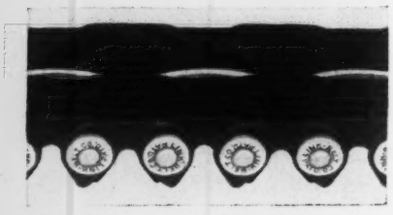
A Division of Borg-Warner Corporation

ITHACA, NEW YORK

NEW MATERIALS AND PARTS

Chain Appearance Is Improved

SILENT chain drives in a new dress, obtained by bluing most of the chain, and treating the washers and guide bars to give them a silvered appearance has been introduced by Link-Belt Co., Indianapolis. The bluing of the bulk of the chain has the effect of placing the silvery parts on a dark blue background, thereby emphasizing the silvery parts.



Modernized chain is available in all standard types, for both industrial first reduction drives and automotive silent timing

The modernized chain, known as Silverstreak, has a distinctive appearance irrespective of whether it is in motion or lying in stock awaiting installation. It is made in all standard types, for both industrial first reduction drives and automotive silent timing; viz., side flanged, middle guide, no back bend and duplex types.

Controls Prevent Accidental Starting

AUTOMATIC motor starters which prevent accidental starting and which permit taking full advantage of the motor's capacity without danger of burning it out have been announced by Lincoln Electric Co., Cleveland. These starters, shown herewith, are of the across-the-line type and fully meet underwriter's requirements.

It is impossible to close the starting current unintentionally due to the design of the control. The red stop button extends around and beyond the green start button. Consequently, a bump or fall against the control would move only the stop button. Once the motor is stopped, the only way it can be restarted is by pressing the recessed start button with the fingertip.

Full advantage of the motor's capacity is permitted by an inverse time limit protection which allows carrying a small overload a long time or a very heavy load a short time. Immediate motor starting upon resumption of current is insured by low voltage release with two wire control.

The new starters are furnished in three types for different horsepowers and 110, 220, 440 and 550 volts. The XLA starter is for 3 and 5-horsepower motors, 110 volts; also 3, 5, 7½ and 10 horsepower, 220, 440 and 550 volts. The XLB starter is for 7½ and 10 horsepower, 110 volts; 15, 20, 25 and 30 horsepower, 220 volts; 15, 20 and 25 horsepower, 440 volts; and 15 and 20 horsepower, 550 volts. The XLBB is for 30 horsepower, 440 volts; and 25 and 30 horsepower, 550 volts.

Unintentional closing of the starting current is impossible in these automatic motor starters due to the design of the control

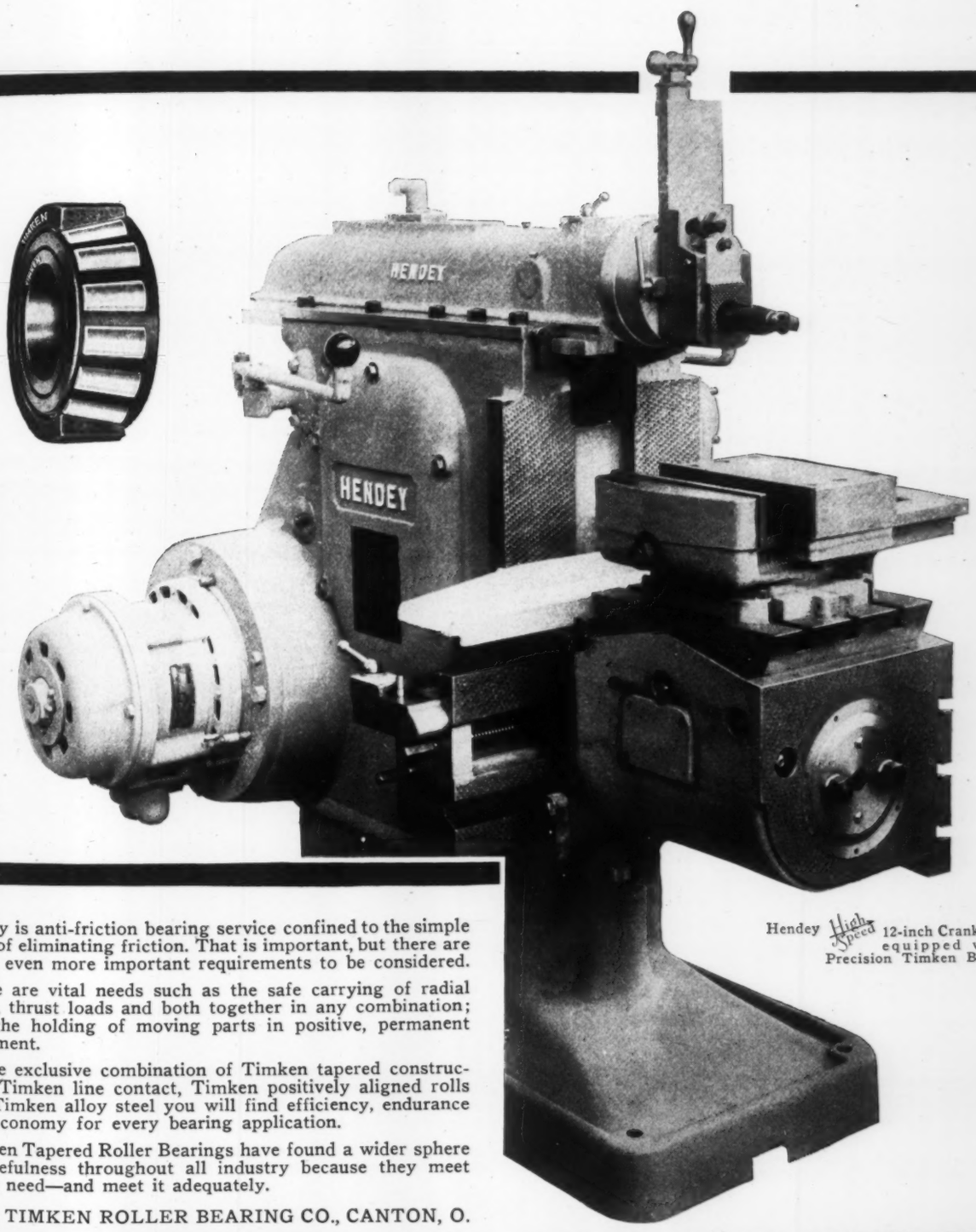
---

Solenoids Operate Brakes

SMALL alternating and direct current solenoid operated brakes in a new line have been added to the electrical equipment being manufactured by Cutler-Hammer Inc., Milwaukee. Three new brake sizes are included with torque ratings ranging from 3 to 75 pounds feet. The brake wheel is relatively large, allowing low total brake shoe pressures which,

Every Bearing Necessity

IS MET BY TIMKEN



Hendey High Speed 12-inch Crank Shaper equipped with 10 Precision Timken Bearings.

Rarely is anti-friction bearing service confined to the simple duty of eliminating friction. That is important, but there are other even more important requirements to be considered.

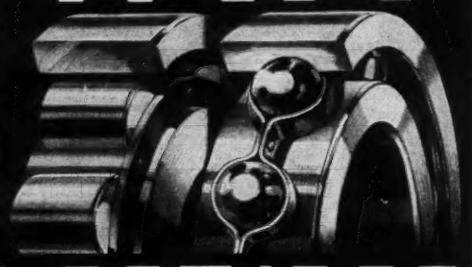
There are vital needs such as the safe carrying of radial loads, thrust loads and both together in any combination; and the holding of moving parts in positive, permanent alignment.

In the exclusive combination of Timken tapered construction, Timken line contact, Timken positively aligned rolls and Timken alloy steel you will find efficiency, endurance and economy for every bearing application.

Timken Tapered Roller Bearings have found a wider sphere of usefulness throughout all industry because they meet every need—and meet it adequately.

THE TIMKEN ROLLER BEARING CO., CANTON, O.

TIMKEN *Tapered Roller* **BEARINGS**

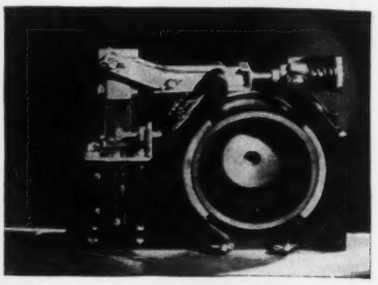
TWIN

PRECISION

IN the past 20-odd years many standards have become flexible, and quality has—in many cases—become a variable thing . . . But throughout this period NORMA-HOFFMANN Precision Bearings have been consistently made to the highest standard of excellence . . . They continue to be the choice of those who measure value by service rendered, and who seek the lowest cost per bearing per year of useful life . . . *Write for the Catalog. Let our engineers work with you. . . . . .*

"NORMA-HOFFMANN"
PRECISION BEARINGS
BALL, ROLLER AND THRUST
NORMA-HOFFMANN BEARINGS CORPORATION,
STAMFORD, CONN., U. S. A.

distributed over the large brake lining area, result in low unit pressure on the lining.

Dimensions of the alternating and direct current brakes are interchangeable, so that machine designers can provide standard mounting holes and apply either type brake as needed.



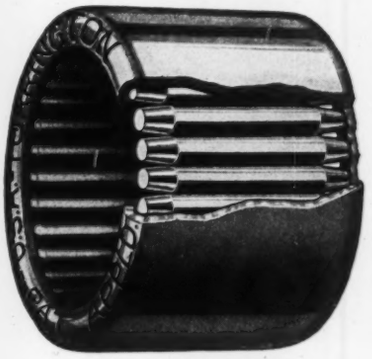
New solenoid-operated brakes are intended for applications on machine tools, conveyors, dumb waiters, printing presses, etc.

Brake shoes use molded brake lining and provide for 180-degree braking surface.

These new brakes, shown herewith, are intended for applications on machine tools, conveyors, small hoists, dumb waiters, overhead door hoisting equipment, small elevators, printing presses, laundry equipment and similar small machines where quick, sure stops are required.

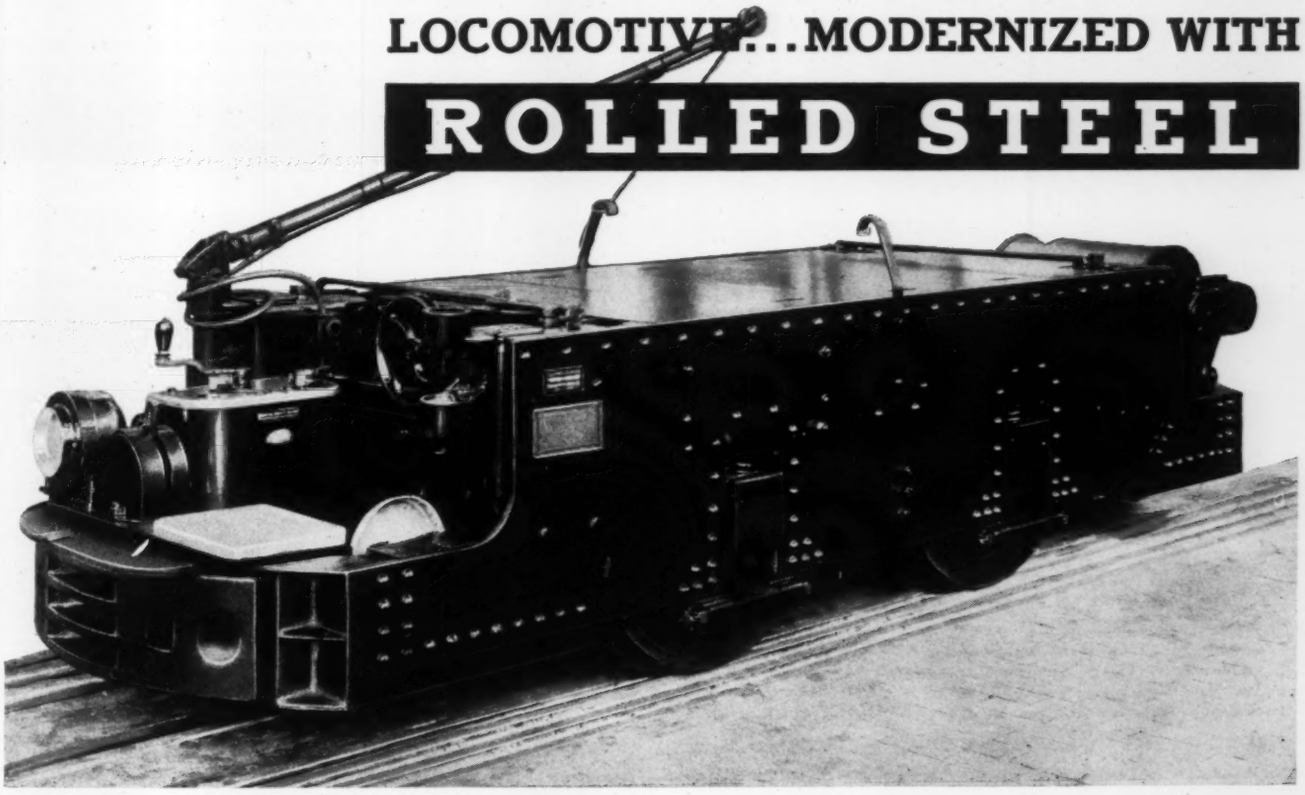
Introduces New Needle Bearings

LARGE storage capacity for lubricant is afforded by the new needle bushing now being marketed by Torrington Co., Torrington, Conn. This capacity is obtained by the use of needle rollers together with the turned in ends or lip construction of the shell, shown herewith. The outside shell is made of drawing steel, cyanide hardened to give a smooth, long wearing bearing surface. Needle rollers are held in place by the unique construction of the shell, without the use of separate retaining rings or washers. These needle rollers are made from high carbon steel, hardened throughout to 0.58 to 0.60 Rockwell C, and are centerless ground to a diameter tolerance of plus 0.0000, minus 0.0002 inch. The



Needles in new bearing are held in place by the unique construction of the shell, without the use of separate retaining rings or washers

FIRST THE OLD MULE HIMSELF... THEN THE ELECTRIC MULE... NOW THE 1934 ELECTRIC MINE LOCOMOTIVE...MODERNIZED WITH ROLLED STEEL



THE entire frame of this electric mine locomotive is fabricated from rolled steel. Weight is used only where it is needed. The frame is sturdy—capable of taking terrific shock without damage. Of all materials available for practical machine construction, rolled steel has the highest resistance to deformation.

The Illinois Shape Book belongs in every modern engineering or design department. Write today for a copy of this 280-page book containing profiles and physical data on a wide variety of rolled steel products.

Before planning your next models, consider these advantages of ROLLED STEEL

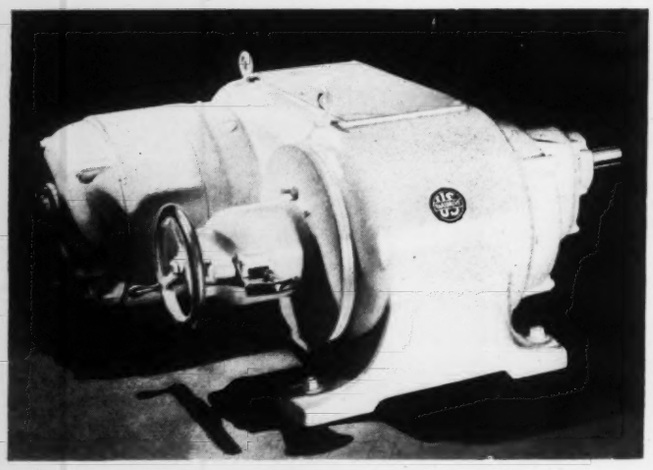
1. First cost is often less.
2. It reduces weight—thus combating high freight rates and opening up new markets.
3. There is no loss due to defects and discards.
4. Lessens the time from design to finished product.
5. Inventories can be kept down . . . pattern storage is reduced.
6. Design can be changed quickly and inexpensively.
7. Permits adaptation of standard machines to unusual requirements.
8. Modernizes appearance—flat, clean surfaces and straight lines are easily obtained with rolled steel.

U·S STEEL

Illinois Steel Company

208 SOUTH LASALLE STREET, CHICAGO, ILL.
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

3 machines in one compact unit



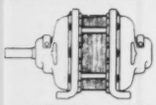
The ONE MOTOR with 1000 SPEEDS

The new U. S. Varidrive motor offers any and all speeds over a wide range. It combines in an integral compact unit the simplest mechanism for replacing and performing the functions of an electric motor, intermediate couplings and transmissions, variable speed device and geared speed reducer.

MICRO-SPEED CONTROL—1 r. p. m. to 10,000 r. p. m.

The Varidrive replaces complicated slip-ring motors. It provides the flexible positive speed control of a direct current motor without complication of wound armatures, commutators, etc. To change from one speed to another the operator merely turns a hand wheel to obtain the precise speed at which the driven machine will operate at highest efficiency. Speed of the driven machine may be accelerated or retarded to the exact r.p.m. necessary—instantly at the turn of the wheel or the press of a button. The U. S. Varidrive motor is also available in combination with the U. S. Syncrogear, to provide any speed reduction desired. The entire unit occupies little more room than a motor. With its infinite variations, Varidrive may well be termed the "motor of a thousand speeds."

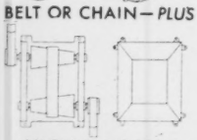
REPLACES



MOTOR — PLUS

COUPLING — OR

BELT OR CHAIN — PLUS



VARIABLE SPEED DEVICE — PLUS

GEARING — PLUS ENCLOSING COVERS

Send for new descriptive bulletin.

U. S. VARIDRIVE MOTOR with Syncrogear

MAIL COUPON FOR BULLETIN

U. S. ELECTRICAL MFG. CO.
1518 S. Western Ave.
Chicago, Illinois

Send your Bulletin describing U. S. Varidrive Motor. Also name of your nearest distributor.

Name_____

Address_____

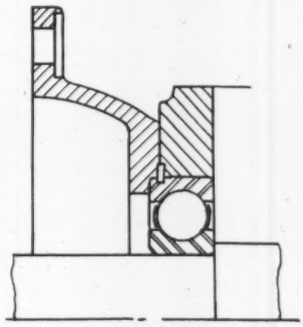
City_____ State_____

circumferential clearance between each roll is normally 0.0001 inch and the total clearance is 0.0005 inch. Either or both of these clearances can be varied to suit special applications.

Snap Ring Bearings Available

SNAP ring bearings, known as the G type, have been made available in a wide range of sizes by Fafnir Bearing Co., New Britain, Conn. This bearing, shown herewith, eliminates one of the shoulders formerly required in a housing where it is necessary to provide for taking a certain amount of thrust in both directions. It consists merely of the addition of a wire ring

Use of snap ring bearing eliminates the need for one of the shoulders formerly required in a housing where it is necessary to provide for thrust



snapped into place in a groove cut on the outside of the bearing outer ring. This wire is placed near one face of the bearing, protruding one-eighth inch or so and furnishing a shoulder integral to the bearing itself.

In general, the wire is placed about $\frac{1}{8}$-inch in from the face of the bearing in a groove approximately 5/64-inch wide and 1/12-inch deep, although these dimensions vary slightly for different sizes. Advantages of the use of the bearing include simplified production of the assembly and compactness of design.

Composition Material An Insulator

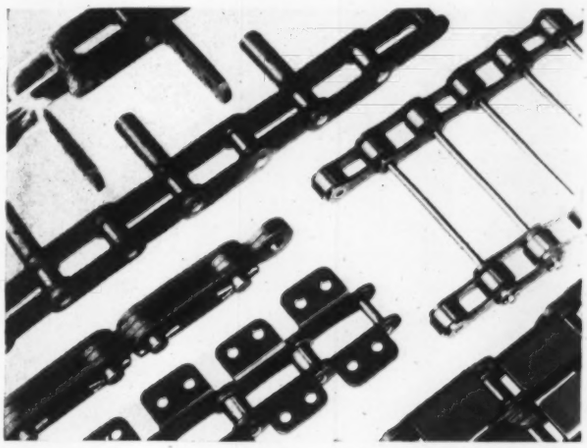
INTENDED especially for insulating applications that must have both good heat resistance and fine appearance, a new grade of Cetec, cold molded, designated as No. 1389 has been introduced by General Electric Co., Plastics department, Lynn, Mass. The material is particularly suited for applications such as electric iron heat-control knobs, cord connector plugs, etc.

In addition to its smooth finished surface, the new material combines a number of characteristics which make it adaptable to a wide range of uses. It is unaffected by temperatures up to

480 degrees Fahr. It has high dielectric strength, 120 volts per mil, and its transverse strength is 6000 pounds per square inch. Moreover, the compound is practically water proof, the water absorption rate being but thirty-five one hundredths of one per cent in 48 hours.

Improved Conveyor Chains Available

A COMPLETE new line of conveyor chains has been placed on the market by Whitney Mfg. Co., Hartford, Conn. As shown in the accompanying illustration, these chains are made in four different sizes and in two types, with



All steel construction of conveyor chain and the use of extended pitch widens field of application

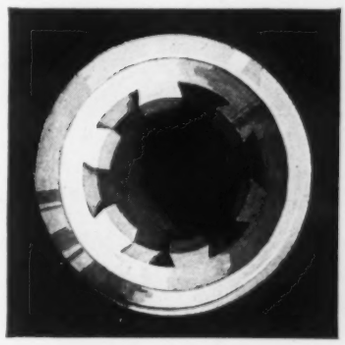
standard and oversize rolls. According to the manufacturer, the value of these chains lies in the fact that standard roller chain construction is used, with an extended pitch. Attachments can be bent, welded or riveted to meet a wide variety of requirements.

All steel construction and the use of the extended pitch design provides light weight with high wear resisting qualities and strength. These conveyor chains are made in two series, 500 and 550. Both series operate over sprockets, but the use of a large diameter roll on the 550 series allows it to be employed as a drag or pressure chain, with the rollers carrying the load.

Expands Line Of Switches

ADDITION of 100 and 200-ampere switches to the new 50,000 line of Type A switches has been announced by Switch & Panel division, Square D Co., Detroit. The new switches, shown herewith, have all of the features of the 30 and 60-ampere switches of this line, with some added points necessitated by the higher capacities.

Troubled....
by JAMMED Screws?



This BRISTO Socket is a sure remedy

SIDEWALL pressure—the cause of rounding-out, splitting and jamming—is eliminated by the unique socket used in all Bristo Cap and Set Screws. The reason is clearly shown by these three little diagrams:—

See how the gear-like action of the Bristo Wrench in the fluted Bristo socket at left guides the pressure AROUND in the direction the screw turns. Then compare this action with the application of the force against the sides of the socket wall in ordinary screws. With the Bristo socket even "soft" alloy screws become practical.

Because of the Bristo principle, delays and trouble are prevented. For the same reason, a Bristo can be set up tighter. All the force necessary for a positive hold can be applied, and needless resetting is avoided. Longer wear, neater appearance and protection against tampering are other worthwhile advantages.

It WILL COST NO MORE to buy these superior screws. Try them. See how they make work easier and improve products. Samples for test and full details will be sent on request.

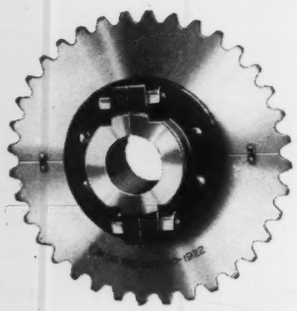
THE BRISTOL COMPANY, WATERBURY, CONN.
Branch Offices: Akron, Birmingham, Boston, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

TRADE MARK
BRISTO
REG. U.S. PAT. OFF.

Hollow Safety **SET SCREWS**
Socket Head **CAP SCREWS**

CULLMAN SPROCKETS

—ORDERED YEAR AFTER YEAR

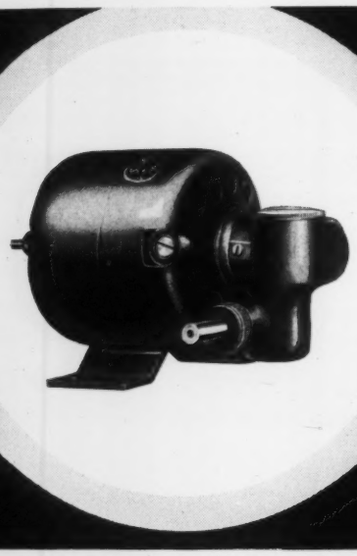


Numerous concerns have been using Cullman Sprockets for 10 years, 20 years . . . and longer. These extended periods of use must mean but one thing . . . complete satisfaction.

Cullman has been furnishing sprockets to satisfied users for many years . . Cullman Sprockets have a long record for accuracy and dependability.

You too will be satisfied with Cullman Sprockets and Cullman service. Write for the Sprocket Book.

CULLMAN WHEEL CO.
1356 Altgeld St. Chicago, Ill.



FRACTIONAL H. P. MOTORS

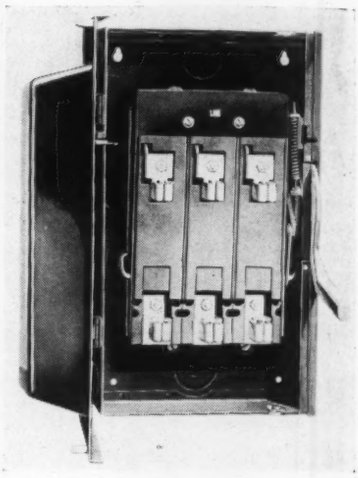
If your requirements involve small motors ranging in size from 1/1000 to ¼ H.P. plain or back-geared in Universal or Shaded Coil Induction or Split Phase types write us. Low prices and a background of more than 40 years as successful small motor producers.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan

OFFICES IN PRINCIPAL CITIES

SIGNAL
MANUFACTURERS OF ELECTRICAL PRODUCTS

They are quick-make, quick-break, with interlocked covers and elevated removable bases for easier wiring. The enclosures are considerably smaller than those of the conventional type of knife switch due to the compact design of the

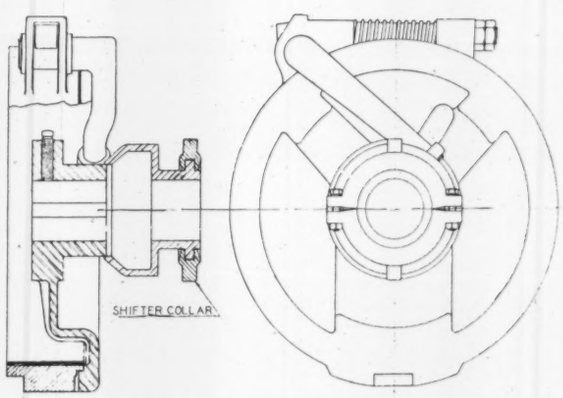


Constant pressure on the contacts is assured by double-break contact with steel spring reinforcements

interiors. Among other features are double-break contact with steel spring reinforcements assuring constant pressure on the contacts for reduced heating and positive pressure contacts. Cast aluminum or cast iron enclosures are weatherproof and dust tight.

Clutches Designed for Heavy Service

DESIGNED precisely for material handling machinery, to "make and break" on hoists, winches, drums, brakes, cables, etc., the series 5 and 6 clutches have been added to the line be-



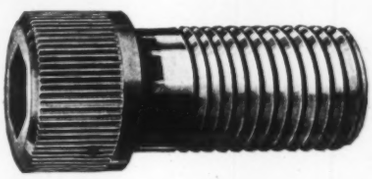
Compression clutch mechanisms can be applied directly to any hub of the proper dimensions

ing manufactured by Conway Clutch Co., 1543 Queen City avenue, Cincinnati, O. The clutches have full floating friction, nonburning contact, drop-forged actuators, steel carrier (drive plate) and simple, accessible adjustment.

In the series 6 clutch, shown herewith, the compression clutch mechanisms only, in large size construction, can be directly applied to a hub of the proper dimensions cast integral with the sprocket, drum, pulley, gear, sheave or like mounting. In the series 5 clutch the full floating band is actuated by a double action leverage fulcrum. Steel and malleable iron are used to give strength with minimum weight.

Knurled Screws Assist Assembly

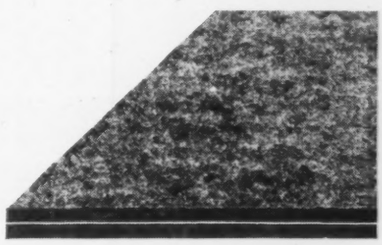
KNURLED head socket-type cap screws, known as the knurled Unbrako have been brought out by Standard Pressed Steel Co., Jenkintown, Pa. The object of the knurling, shown herewith, is to assist in driving the screw by hand up to the point of final tightening. In driving screws, a mechanic will, whenever possible, turn in the screw with his fingers in order to save time. Hence a screw with a knurled head makes it possible to obtain a firm grip. Tests are said to show that this new socket head cap screw has a torque five times that of smooth-head cap screws.



Knurling on head of socket-type cap screws materially speeds assembly operations

Felt Is Bonded To Metal

FELT bonded metal, manufactured by a method which produces a permanent bond between felt and metal, is now being offered jointly by H. H. Robertson Co., Pittsburgh, and The Felters Co., Boston, Mass. In the process, a metal coating is fused between the layer of felt and the metal so that the fibers of the felt are embedded in the metal coating and there is an actual com-



Fibers of felt are embedded in the metal coating fused between the layer of felt and the base material

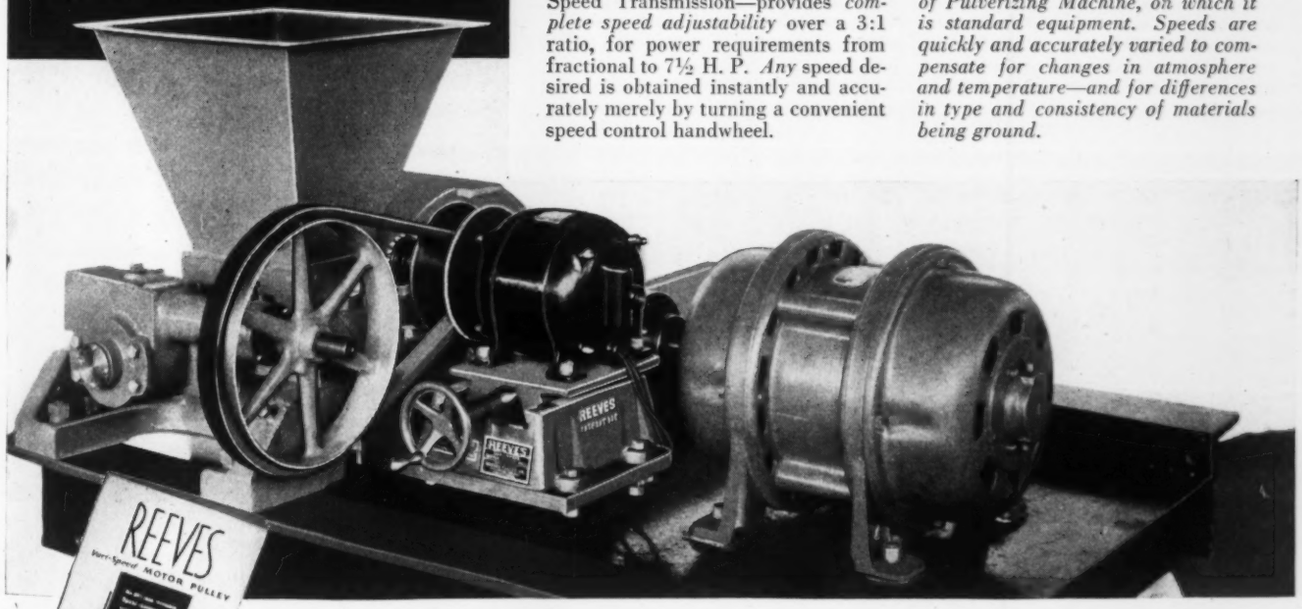
★ REEVES ★
VARI-SPEED
MOTOR PULLEY

THE REEVES Vari-Speed Motor Pulley is an efficient, compact variable speed unit, *applicable directly to the standard shaft extension* of any constant speed motor.

This simple, sturdy unit—built by the makers of the REEVES Variable Speed Transmission—provides *complete speed adjustability* over a 3:1 ratio, for power requirements from fractional to 7½ H. P. *Any* speed desired is obtained instantly and accurately merely by turning a convenient speed control handwheel.

Made in seven sizes. Low in cost; quickly installed. Used as standard equipment by many leading manufacturers of industrial machines.

• *Illustration shows* REEVES *Vari-Speed Motor Pulley driving feed screw of Pulverizing Machine, on which it is standard equipment. Speeds are quickly and accurately varied to compensate for changes in atmosphere and temperature—and for differences in type and consistency of materials being ground.*



REEVES PULLEY CO., Columbus, Ind.

Without obligation, send copy of catalog H-200 which gives complete information on the REEVES Vari-Speed Motor Pulley and illustrates specific machine applications. 9-34

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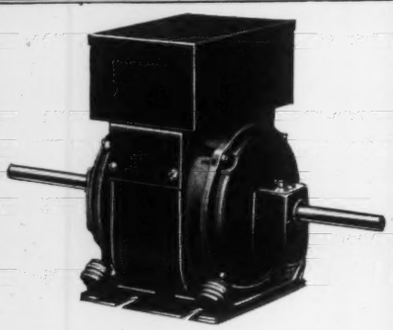
Company.....

Address.....

BALDOR
A BETTER MOTOR



Resilient mounted, capacitor type blower motor.

Do You Require a Special Motor?

Baldor motors are obtainable in repulsion induction, capacitor, single-phase, polyphase and direct-current types—in high and medium torque—in horizontal, vertical, solid or resilient mountings. Especially applicable to refrigerators, oil burners, humidifiers, blowers, pumps, unit heaters, and similar equipment.

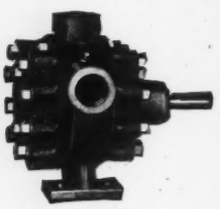
When *your* reputation depends on the motor—depend on Baldor.

Full information on request. No obligation.

BALDOR ELECTRIC COMPANY
4353-A Duncan Avenue, St. Louis, Mo

PUMPS FOR ALL PURPOSES

●FOR HYDRAULIC POWER TRANSMISSION



909 Series

No. 909 is one of several Roper Pressure Pumps for hydraulic power transmission. It is built in five sizes, for pressures up to 750 lbs. Used on machine tools for rapid traverse, tool feeds, press work; for sidewalk elevators, portable truck lifts, etc.

All Roper rotary gear type pumps are made in a wide variety of sizes, capacities and with maximum mounting flexibility.

Put your pump problems up to Roper.

Write for Bulletin No. R-5-MD.

Dependable Pumps Since 1857

GEO. D. ROPER CORP., ROCKFORD, ILL.

THE HEART OF POWER

ROPER PUMPS

plete bond which will not separate under heat, cold, moisture, fumes or mechanical friction, strain or distortion. The application of felt may be to one or both sides of the metal, while the thickness of the felt may be varied to suit requirements as can also the weight of the sheet metal. After the felt is applied, the metal can be bent or shaped without breaking the felt contact.

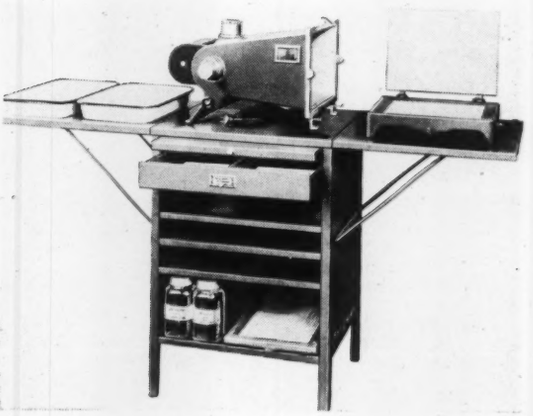
New Rubber Belts Are Endless

A REVOLUTIONARY method of making belts endless has been developed by B. F. Goodrich Co., Akron, O. In the construction, the seam is embedded or countersunk below the surface of the belt in such a position as to shield it from wear or windage. This relieves the seam from strain and protection is made possible by a thick cushion of rubber reinforced with bias fabric which is permanently vulcanized into position.

Although the "plylock" belt joint has been used successfully in the field by several companies during the last year or two, only recently was it definitely decided to offer it for public use.

Blueprinter Is Compact

EASE of operation and compactness feature the new Speedway blueprinter of F. A. Smith Mfg. Co. Inc., Rochester, N. Y., by which 9 by 12 prints can be quickly made in the engineering department. In making the prints, the tracing and blue print paper are inserted in the printing frame, then they are slid in front of the projector. The timer is set at proper indicator number and the arc is turned on. When the bell rings the exposure is completed. The print is removed from the frame, washed in



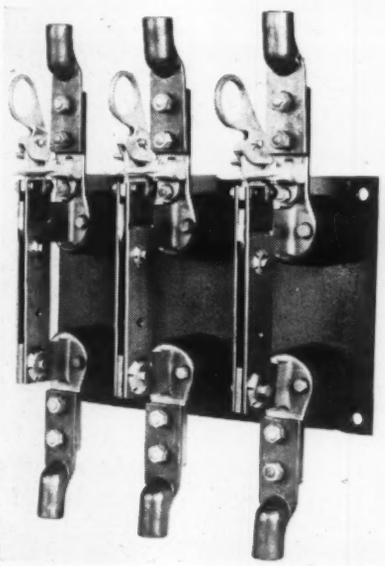
Blueprinting equipment gives a compact means of producting nine by twelve prints

water and then in developer for a few seconds each and the print is finished. All of the equipment necessary is shown in the accompanying illustration. A dryer for the prints is at the right.

The automatic timing mechanism is attached to the bottom of the printer. With it the exposure can be controlled to give the most perfect print on the user's actual line voltage. The projector is made from pressed steel, reinforced with aluminum castings.

Switches Employ Silver Contacts

SILVER-TO-SILVER line pressure contacts feature the new indoor disconnecting switches introduced by General Electric Co., switchgear sales division, Philadelphia. The switches, shown herewith, have ratings as high as 1200 amperes at 5000 volts. The silver, applied to the contacts by a special process which produces a surface of unusual wearing qualities, eliminates troublesome oxidation and its inherent disadvantages.



Silver applied to switch contacts produces a surface of unusual wearing qualities and eliminates oxidation

The complete line includes hook-operated, single and double-throw blade transfer switches with half or full capacity blades, single-throw tandem transfer switches with full capacity blades, and group-operated switches controlled manually or electrically. The single or multipole switches are mounted on compound insulators and metal bases. The insulators are made of noninflammable, arc-resisting cold-molded material and have a dry flashover of 25 kilovolts. The accompanying illustration shows a 5000-volt, 600-ampere, 3-pole, single-throw type switch mounted on a 5000-volt molded insulator and steel base.

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ALL STEEL

CONVEYOR CHAINS

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Roller Chain Construction

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Combining Slow Speed, Power and Compactness With all the Advantages of Series Universal Motors

Dumore offers an unusual new motor — the K3-M! It is 1/7 H. P. and is available with gear ratios ranging from 5 to 1 up to 34 to 1, permitting gear shaft speeds from 1300 R. P. M. down to 185 R. P. M., at full load. . . . Write for full details of the new universal motor.

DUMORE COMPANY, 100 Sixteenth Street, Racine, Wisconsin

DUMORE MOTORS

Circulation or Pressure

Thousands of installations prove the performance of these compact and efficient Brown & Sharpe Geared Pumps. 4 Sizes—for every ordinary lubrication or coolant requirement. Complete circular sent on request. Brown & Sharpe Mfg. Co., Providence, R. I.

Geared Pumps

— 4 Sizes —
Nos. 1, 2, 3 and 4

Brown & Sharpe Pumps
Geared — Vane — Centrifugal

Pitfalls Await the Unwary in Assigning Patents!

(*Concluded from Page* 18)

to others, it is advisable to stipulate the prices, terms and conditions of sale of the patented devices, as sold by the licensees. This is primarily done to prevent underselling. The question of so-called price fixing has been litigated from time to time and it appears now that the licensor in such cases may stipulate the price at which the licensee may sell the articles manufactured under the license.

However, the patentee, or licensor, cannot control the price at which the retailer sells the patented device to the public. The latter has been held to be invalid as being in restraint of trade, because when once an article is sold the vendor loses all control over the device As a general rule, a license is personal to the licensee and, therefore, is not transferable unless the terms specify otherwise. Therefore it is usually a good policy to include some such provision in the license agreement if the business of the licensee is such that it requires sub-licenses. A license agreement in the absence of express provision continues until the termination of the original term of the patent.

Beware of Confidences

When an invention is submitted by an outside inventor to a corporation, or other business exploiter of the device, it is best to refrain from accepting the disclosure of the invention by the outside inventor in confidence or under conditions which may be construed as a pledge of secrecy, or under an agreement not to appropriate the invention. The reason for this results from the fact that it may be possible for the outside inventor to sue the manufacturing concern for appropriation of the invention, even though the inventor has no patent, or even though he has a patent which is subsequently declared invalid. The basis for such a suit is on the breach of contract or confidence, and is not upon any patent right. One of the leading cases on this point relates to certain disclosures made in confidence to Stutz Motor Car Co. by the inventor, Booth.

The invention disclosed related to an automobile chassis and driving mechanism that would enable the floor of the automobile body to be placed considerably closer to the road surface than was usual in practice, *Fig.* 1. The court in this case allowed damages to the inventor for the appropriation of his designs by the Stutz Co. even though the patent covering the improvements was declared invalid. The court in

part said as follows:

> "To the extent, therefore, that the Booth plans, communicated in confidence to Stutz, did enter into the design of the Stutz car, Stutz did inequitably appropriate those plans and should account to Booth therefor. By this we do not mean that Stutz should account for and Booth should receive all profits which accrued to Stutz from its new car. Had the Booth patent been sustained, the measure of Booth's recovery would of course be decidedly different. But, as we have held, the lower center of gravity, made possible by the underslung worm drive, was a matter of selection in the designing of a car, and was open to Stutz quite regardless of Booth's design. That very important feature, thus open to all, *contributed materially to the 'eye appeal' of both cars,* and as well as to the ready market for the new Stutz car; *and recovery may not be predicated thereon.* But the Booth plans evidently did in some measure facilitate the production of the Stutz car, as well as the earlier placing of that car upon the market; and to whatever extent it may appear that the Booth designs, apart from those features of them which were common property, contributed to the success of the Stutz car, as well as to the extent that it may appear that Booth through Stutz's inequitable appropriation was harmed, Booth should have recovery against Stutz."

It should be noted, however, that this case holds that the appropriated features of the invention must be something more than public property, because everybody has a right to use that which is public. In other cases, however, it was held that the subject matter which was unlawfully appropriated must be patentable, and that the burden is on the inventor to show affirmatively that his invention is new and patentable.

A listing of articles on this and related subjects previously published in MACHINE DESIGN appears at the end of "Patents Should Be Prepared with Care But Without Undue Delay," by George V. Woodling, p. 24, July, 1934.

Recorder Gives Long Record

AN ELECTRICAL operation recorder which provides a long record on a fast moving round chart has been brought out by Bristol Co., Waterbury, Conn. Instead of making one circular record, this instrument draws a spiral curve, starting at the outer edge of the chart and gradually moving toward the center. This action is accomplished by a telechron cam which continuously resets the record making move ment.

The unit provides an open record with the easy filing and ready reference characteristics of the round chart. It is fitted with a chart driving clock that makes one revolution per hour and with a separate telechron motor-driven cam that makes one revolution in eight hours. Resulting record is a spiral curve covering eight rotations of the chart with approximate ¼-inch spacing of the record line. The mechanism which records the trend of an operation is a small electromagnet that is energized when an external circuit is closed. Movement of this magnet actuates the pen arm. The entire movement is housed in a moisture-proof rectangular model 40-M case.

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3 Styles of VIKING ROTARY PUMPS

And all of them incorporate that world-famous and widely imitated Viking "Two Moving Parts" Principle. All are constructed of laboratory-tested metals and machined to fine-watch precision.

Standard — All drives and styles. Capacities of 1/5 to 1,050 G.P.M. For the economical handling of all grit-free liquids.

Hydraulic — For the operation of elevators and lifts . . . for the actuation of machine tool movements . . . use the Viking Hydraulic Pump. Capacities of 5, 9, 13, 30, 35 and 45 G.P.M.

Coolant — Operates with a smooth, continuous flow so necessary to the successful operation of machine tools. Capacities of 5, 10, 15, 20 and 35 G.P.M.

Write for FREE Folders. Merely specify type of pump or pumps you are interested in.

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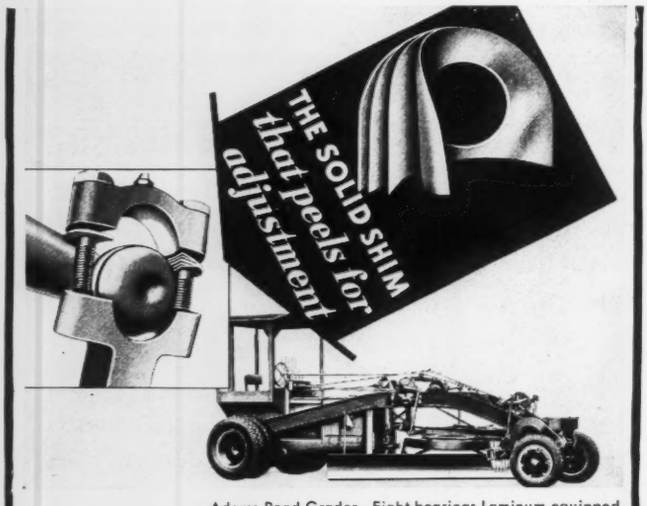
Cedar Falls, Ia.



Adams Road Grader. Eight bearings Laminum equipped.

• quicker adjustment for ball-and-socket bearings

Laminum shims make it easier to KEEP bearings in correct adjustment by providing means of taking up .002" or more at a time. No miking . . . no filing. Just p-e-e-l the laminated brass shim. Many equipment manufacturers are providing Laminum shims as a service adjustment feature.

LAMINUM

LAMINATED SHIM COMPANY, INC.
2126 Forty-fourth Ave., Long Island City, N. Y.

249

ALLOYS (NICKEL)—The application of monel metal and nickel to industrial processing equipment is very completely covered in a new booklet of International Nickel Co. Inc., New York. Besides giving data on the physical and mechanical properties of these materials, the booklet contains considerable miscellaneous information, including instructions on the selection of suitable welding rod and other details on fabrication. Comprehensive tables give the applications of the material, classified by the material handled and the industry or process where it is used.

BEARINGS—Needle bearings of special design are described in a recent bulletin of Torrington Co., Torrington, Conn., which describes the advantages of the units. Information on the bearings in the bulletin includes specifications and tolerances, rated radial load capacity, recommended fits and similar data.

CHAINS—Palmer-Bee Co., Detroit, is distributing section 101 of its general catalog No. 100 giving a complete description of all steel and drop forged chain and their sprocket and traction wheels for use in elevating and conveying installations as well as positive drives for power transmission purposes. This 220-page booklet is the first of nine sections to be published by the company on chains, conveyor machinery and power transmitting machinery.

CLUTCHES—Conway Clutch Co., Cincinnati, has published bulletin 36 on its line of compression clutches. Included in the bulletin is an extension of the company's line which embodies a new development in the construction of the clutches and several improvements in design to suit the heavier and more severe service.

CONVEYORS—All-steel conveyor chains, of roller chain construction, are presented in catalog V-116 of Whitney Mfg. Co., Hartford, Conn. The booklet describes the chains completely, gives dimensions and application information. Also included is data on sprockets for use with the chains.

DESIGN DEPARTMENT—Charles Bruning Co. Inc., Chicago, is distributing a booklet entitled "Black and White Magic," which discusses the method of producing black and white prints, advantages of the process, and similar factors. Another publication of the company is "The Bruning Perspective" in which are presented products of the company intended for the design department.

DRIVES—Continuous-tooth herringbone speed reducers and gears are comprehensively treated in catalog No. 137 of D. O. James Mfg. Co., Chicago, which gives a complete description of each of the units and photographs of applications and of the units disassembled. Also included in the publication are rating tables for the reducers, dimensions and similar data. Complete information and engineering data is also given for generated continuous-tooth herringbone gears.

DRIVES—Dayton Rubber Mfg. Co., Dayton, O., has prepared a booklet on its line of V-flat drives in a complete range of sizes for all ratings up to 300 horsepower

or more, and for all general industrial service where large speed ratios and very short centers are involved. The V-flat drive differs from the regular V-belt drive in that the large pulley is flat instead of grooved, the bottom surface of the specially constructed belts riding on the flat surface of the pulley. Complete engineering information is included in the booklet.

ELECTRONIC EQUIPMENT—A new catalog insert describing type LE photorelays is issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The bulletin describes the application, construction, operation, specifications and advantages of the relays which are applicable to all types of industrial control.

MAGNESIUM—Descriptions, properties, specifications and uses of magnesium and dowmetal are included in the new booklet on chemicals published by Dow Chemical Co., Midland, Mich. Over 250 products are listed, comprising heavy, industrial, pharmaceutical and aromatic chemicals.

PACKING GLANDS AND PACKING—Chicago Rawhide Mfg. Co., Chicago, has prepared a new catalog which contains a complete list of unit oil retainers, including 130 new standard sizes now available.

PUMPS—Worthington Pump & Machinery Corp., Harrison, N. J., is distributing a bulletin on its line of centrifugal pumps with single stage volute. Complete specifications of the pumps and a cross-sectional illustration showing the construction in detail are included.

SHAPES—Cold worked parts as a substitute for heat treated parts are discussed in a recent bulletin of Union Drawn Steel Co., Massillon, O.

SHEETS—Uses of zinc alloy steel sheets are described in a folder just issued by Inland Steel Co., Chicago.

TESTING EQUIPMENT—E. Leitz Inc., New York, has published catalog No. 52 B 1 on its line of metallographic equipment. Presented in the publication is an arrangement for darkfield illumination by means of which detrimental reflection is avoided.

WELDED PARTS AND EQUIPMENT—Simplified arc welding is discussed in a recent bulletin of Hobart Brothers Co., Troy, O., which describes the equipment which can be used in the process.

WELDED PARTS AND EQUIPMENT—Lincoln Electric Co., Cleveland, has prepared a bulletin on the shielded arc which gives information on the metal structure produced in this type of welding, physical properties of the welds, and similar information.

WELDED PARTS AND EQUIPMENT—Machine parts of all commercial metals fabricated by welding by Struthers-Wells Co., Warren, Pa., are presented in bulletin M13 of the company which offers this parts service to manufacturers. The bulletin pictures the parts, gives details of the available service, and outlines the test precautions taken in their production.

WHEELS—A 4-page booklet on its newly-introduced line of Vulc-On rubber tired wheels for industrial trucks has just been issued by B. F. Goodrich Co., Akron, O. The booklet gives data concerning comparative tests between rubber tired and steel wheels.

SHAKEPROOF

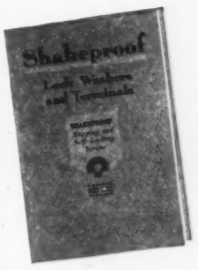
CLOSE-UP VIEW OF A SINGLE TWISTED TOOTH

TOP BITING EDGE

LOWER BITING EDGE

Look Closely

AT THIS TWISTED TOOTH



Send today for your free copy of this complete Shakeproof Catalog. Explains thoroughly the many advantages that Shakeproof offers—also shows new patented Shakeproof products.

HERE you see the reason for Shakeproof's great locking power. This exclusive feature makes possible the most positive method for holding nuts and screws absolutely tight. A solid, rigid contact is made between the nut and the work, producing a lever action which makes the two biting edges dig in deeper as vibration tries to loosen the nut. Now, consider that there are several twisted teeth on each Shakeproof Lock Washer—each one exerting its powerful force against any backward movement of the nut. The performance of your product is certain to be definitely improved by this modern locking principle—Write for free testing samples today.

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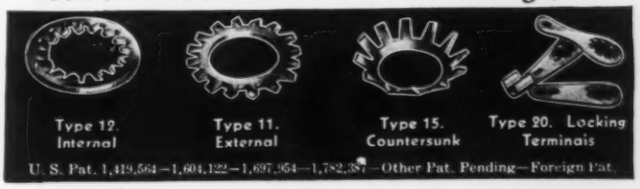

U. S. Pat. 1,419,564—1,604,122—1,697,954—1,782,387—Other Pat. Pending—Foreign Pat.

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—a Janette for Every Job

With the many types and sizes and the extremely wide range of ratios, you can invariably find a Janette Motorized Speed Reducer to meet the exact requirements of your machine design and application.

Janette Motorized Speed Reducers, in 1/5 to 5 horsepower sizes, are obtainable in Single Reduction Worm Gear, Double Reduction Worm Gear, and Spur and Combination types. Write for Bulletin 22-1 and see how their many good features will add to the efficiency and salability of your machines.

Motor-Generator Sets—A. C. and D. C. Motors

Janette Manufacturing Company also make a wide line of motor generators, alternating current and direct current motors, rotary converters, gasoline motor driven electric plants, etc.

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BLACK AND WHITE PRINTS"

"They're a lot easier to read than blue prints, for one thing, because they are true Black and White *positive* prints. We can check them quicker—and changes made with pen, pencil or crayon show up clearly on the white background. BW Prints are mistake-preventers and time-savers. We produce them in our own blue print room FASTER than we can make blue prints!"

Anybody with blue printing equipment can enjoy the advantages of BW Prints. These prints are made *without the use of a negative*, and need no washing or drying. Write for our FREE book which tells all about BW.

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• • •

MACHINE DESIGN is a monthly technical publication conceived, edited and directed expressly for those executives and engineers responsible for the creation and improvement of machines built for sale, and for the selection of the materials and parts to be used.

Business Announcements and Sales Briefs

G H. BURKHOLDER, formerly of Philadelphia, has been appointed western sales manager of the positive drive division of Link-Belt Co., Chicago, with headquarters at the company's Dodge plant in Indianapolis. W. H. Kinkead has been named manager of sales of Link-Belt speed reducers, with headquarters in Philadelphia. He succeeds Mr. Burkholder. G. L. Gansz succeeds Mr. Kinkead and will handle sales of the positive drive division in the Philadelphia office.

* * *

The name of Udylite Process Co. has been changed to Udylite Co., while the general offices and laboratories of the company have been moved to enlarged and improved quarters located at 1651 East Grand boulevard, Detroit. Personnel and policy of the company remain the same.

* * *

R. J. Roy, formerly Cleveland branch manager for the pump and electrical department of Fairbanks, Morse & Co. has been appointed Cleveland district manager for Allen Bradley Co., Milwaukee.

* * *

Revere Copper & Brass Inc., New York, has opened an office at 911-912 Rhodes-Haverty building, Atlanta, Ga. Walter W. Fitts is Atlanta district representative for the company.

* * *

United States Rubber Co. has appointed Ralph C. Harden as manager of packing sales in the mechanical goods division. Mr. Harden will be located at the company's main offices at 1790 Broadway, New York.

* * *

Edwin C. Stout has been appointed sales manager of the eastern district for Wickwire Spencer Steel Co., 41 East Forty-second street, New York. Percy Jenkins has been appointed New England district sales manager with offices at 80 Webster street, Worcester, Mass.

* * *

W. T. Davidson, for several years in charge of development, research and other technical activities for Struthers-Wells Co., Warren, Pa., has been appointed manager of the machine parts division for the company. This department is making developments in the use of welded parts to replace machinery castings.

* * *

Philadelphia Steel Sales Co., Philadelphia, has moved its offices from the Commercial Trust building to room 1514 Lincoln-Liberty building, Broad and Chestnut streets. The company represents Corrigan, McKinney Steel Co., Cleveland, Otis Steel Co., Cleveland, Wrought Iron Co. of America, Lebanon, Pa., and Titusville Forge Co., Titusville, Pa.

* * *

Miles C. Smith, for several years manager of sales promotion for Stoody Co., Whittier, Calif., manufacturer of welding rods and equipment, is now associated in a similar capacity with Rich Mfg. Co. Ltd., Los Angeles. The Rich company has arranged to take over the manufacturing and marketing of welding machinery, rods and electrodes formerly handled by Karl Strobel Corp.

* * *

National Motor Bearing Co., San Francisco, has acquired the factory building in Oakland, Calif., formerly occupied by the Pacific Coast division of Victor-R. C. A. Corp. Production in the new factory is planned to start about Oct. 1.

* * *

Grosvenor C. Barry has been appointed general sales manager of Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

* * *

, Oscar E. Berg has been made district sales manager at Houston, Texas, for Allegheny Steel Co., Brackenridge, Pa.

* * *

Harold E. Trent Co., Philadelphia, manufacturer of electric heating units and electric furnaces has opened an office in charge of A. H. Gurtner at 143 Liberty street, New York.

* * *

James P. Adams, formerly with General Electric Co., is now sales correspondent with Struthers Dunn Inc., 138 N. Juniper street, Philadelphia. Mr. Adams will assist in handling customers' engineering problems.

* * *

J. C. Sprague has joined the staff of Acheson Colloids Corp. as assistant secretary and assistant treasurer. He will be in charge of patent, trade-mark, tax and financial matters of the corporation.

* * *

George A. Higgins has been appointed assistant manager of sales and Joseph G. Armstrong Jr. has been named assistant to the manager of sales in the Pittsburgh district sales office of Carnegie Steel Co.

* * *

Universal Power Corp., 1919 Clarkstone road, Cleveland, has appointed Metalweld Inc., 2617 Hunting Park avenue, Philadelphia, its distributor in the Philadelphia district for arc welders, electrodes and supplies.

* * *

Ernest A. Earle has been appointed sales representative in Pennsylvania, New York and the New England states for the industrial division of Aluminum Industries Inc., of Cincinnati, manufacturer of Permite Products. Mr. Earle's headquarters will be at 344 Stillwell avenue, Kenmore, Buffalo, N. Y.

* * *

Taylor-Winfield Corp., Warren, O., manufacturer of electric Butt, spot and seam welders, has announced the opening of a Detroit plant located at 14307 Third avenue, Detroit. This plant will have a complete engineering staff, experimental department, manufacturing departments, and facilities for manufacturing special resistance welders.